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Transactions of the Australasian Medical Congress  
(British Medical Association)

Second Session: Dunedin, February 3 to 10, 1927.



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## COMBINED MEETING—SECTIONS V AND VIII.

### CRIME AND INSANITY.

By S. J. MINOGUE, M.B., Ch.M., Diploma of Psychiatry  
(Sydney),

*Resident Medical Officer, Mental Hospital,  
Gladesville, New South Wales.*

(Continued from page 384.)

The detection of mental deficiency in criminals is an urgent and much neglected necessity in Australia. I have seen criminals with long police records, whose mental deficiency was recognized only when they developed various forms of mental disease. Now society for its own protection and for the protection of its citizens has found prisons in which to incarcerate those who offend against it or its laws. It seeks to reform criminals and yet it fails to recognize that many of them cannot be reformed, because they have not the mental development necessary to appreciate laws, to see the wrong in the crimes they commit or to control effectively their primitive instincts which are so often anti-social. Such prisoners are released after serving their sentences and fall again and again into the same crimes. They cannot be held responsible for their crimes. Fourteen is recognized in law as the age of full mental development; many criminals have a mental age far less than fourteen and yet such prisoners often serve repeated sentences in gaol and their mental deficiency is for ever unrecognized. Urgent legislation and reform is necessary. All mentally defective criminals must be recognized, an ideal which could be accomplished only by submitting every prisoner to expert psychological examination. Those who are mentally defective, must be treated in colonies and if necessary in mental hospitals. Only in this way can they be effectively supervised and trained in useful occupations. Some have even advocated the sterilization of such prisoners. I agree with the views of Devine who, writing in the *Medical Annual*, 1926, condemns the method as futile and unnecessary.<sup>(2)</sup>

#### Prisoners with Mental Diseases other than Mental Deficiency.

As a general rule I have found that the crimes committed by the criminal insane are the direct result of the mental disease present. Very often

their first crime is an early manifestation of disordered mental function. A patient in the early stages of general paralysis of the insane stole a motor car because he believed that he owned every motor car in the world and could claim any car he liked. Another patient, a boy of fourteen, developed *encephalitis lethargica*. After the attack he became a truant at school, an incorrigible thief and frequently ran away from home. He was suffering from an alteration of personality, one of the sequelae of *encephalitis lethargica*. One is apt to think that those highly respected citizens so often staunch and respected churchmen, who startle everyone by thefts, by gross sexual indiscretions and crimes, are showing the first signs of that mental deterioration, that loss of judgement, that blunting of their moral sense, which is so often the concomitant of thickened arteries and commencing old age.

Amongst the criminal insane all varieties of mental disease are met with. Some are criminals because of their mental disease, others develop mental disease after long years in prison. Criminals who become insane whilst in prison, are not often seen in mental hospitals in New South Wales. The prison psychoses, Ganster's syndrome, are but rarely seen. Undoubtedly such cases do occur, but they are not certified. I have seen only one undoubted case of Ganster's syndrome in four years. Other forms of mental disease may arise in prisoners. For instance two prisoners died in Gladesville last year of general paralysis of the insane. They showed the first signs of their disease whilst serving sentences. Among those who are criminals, because they are insane, primary dementas are often seen. They commit all varieties of crime—vagrancy, stealing, impulsive homicidal attacks and in some cases murder. Sometimes primary dementas go to some pains to commit their crime. The patient who fatally shot a nurse at a mental hospital in New South Wales some years ago, and who then attempted to shoot the medical superintendent, made somewhat elaborate plans for his crime.

Epileptics, manic-depressive psychotics, dementas other than primary are seldom seen. Hallucinatory psychoses and paranoid conditions form a large percentage of our cases. The victims of hallucinations frequently commit crime in response to their hallucinations. A patient heard a voice telling him to burn a haystack and he obeyed! Another patient has twice shot men whilst under the influence of alcoholic hallucinations. In both instances he heard

them calling him a "b—— b——" and he shot them. These words are practically universal in alcoholic hallucinations. They are undoubtedly due to some alcoholic stimulation (? peripheral ? central) of the auditory path and are akin apparently in their origin to the uniformity of visual hallucinations seen in *delirium tremens*.

In paranoid we see criminal insanity at its highest intellectual level. Paranoics amaze one by their intelligence, by their preparation for, by their attempts to justify the murder they have committed. A patient at Parramatta killed the man about whom he had developed systematized delusions of persecution. He has spent years in writing a book in which he seeks to justify his crime.

Two classes of patient merit special study, the moral imbecile and patients the victims of irresistible impulses.

#### Moral Imbecility.

The moral imbecile is usually classified as a mental defective, but for convenience I am considering him here. He is a patient who is of the average or even of superior intelligence, who has no obvious psychosis and yet who is so lacking in moral sense that he will commit crime after crime in spite of repeated punishment. In all respects he is incorrigible, "his egotism is unbounded, he is a conceited braggart, a liar too of the first order."<sup>(3)</sup>

A youth of twenty, of average intelligence, was an incorrigible thief outside and the *bête noir* of his relatives. In hospital he excited the convalescent patients to rebellion. In the refractory ward he twice set fire to his room with matches which could not be found even after the closest searching. Again in spite of the closest supervision he twice managed to escape from the ward.

The treatment of such a patient is an unsolved problem. He is too irresponsible and too mentally unstable to trust in the outside world. Punishment is of no avail. Kindness is unappreciated and futile. In hospital he must be under observation day and night and his hospital life is monotonous, irksome and futile.

In spite of the fact that gaol authorities are most anxious to have such a patient certified and sent to a mental hospital, I am convinced that rigid gaol discipline offers the best chance of amelioration of the patient's condition and gives him the best opportunity to make his life at least of some benefit to the community. To detain him in a mental hospital one must turn the hospital into a gaol, a procedure which is totally opposed to all psychiatric ideals. I am fully aware that in advocating the treatment of such a mental patient in gaol, I am directly opposing the principles laid down in this paper. It is an admission of hopelessness and an admission of profound ignorance of the treatment and pathology of moral imbecility.

#### Irresistible Impulses.

An irresistible impulse is defined by Stoddart "as a state of mind in which the patient feels impelled to perform certain acts against his will."<sup>(4)</sup>

A patient of normal intelligence whilst awaiting trial for indecent assault, developed acute confusional insanity and was certified. When convalescence became established, it was noticed that he could not be trusted near women. In the sight of attendants and nurses he would attempt to molest any female patient near him. Finally, when going into Sydney, to interview the solicitors who were defending his case, he attempted to interfere with a girl who was sitting opposite to him in the tram.

In this patient the sight of women was a stimulus to a conditioned reflex, which went on to its usual termination in spite of the patient's will.

Irresistible impulses have long been recognized. We often meet patients who are tortured day and night with morbid impulses to kill, to burn things, to steal. They have medico-legal significance. Sir James Stephen gave his opinion: "A person should not be punished for any act when he is deprived by disease of the power of controlling his conduct, unless the absence of control has been caused by his own default" (alcoholism).<sup>(5)</sup>

Doubtless some habitual offenders have these morbid impulses. Who, however, without a definite, proven and detailed knowledge of the prisoner's past life, actions and tendencies will swear that he has irresistible impulses? Diagnosis at the best is difficult, uncertain and in many cases a matter of opinion.

#### The Legal Responsibility of the Criminal Insane.

Authorities agree that the State is the sole judge of criminal responsibility and it alone has the power of deciding whether a prisoner is responsible or not.<sup>(6)</sup> On the other hand the sole duty of the alienist is to say whether an accused prisoner has a definite mental disease or not. However, the responsibility of the criminal insane is a source of perennial and often bitter argument between alienists and lawyers. These arguments centre chiefly around the unfortunate McNaughton rules which were formulated in 1843 and which form the chief basis on which the legal responsibility of accused prisoners is decided. Lawyers refuse to believe, for instance, that paranoics who can defend themselves so brilliantly in court, are insane. They refuse to believe alienists who say that such prisoners have a mental disease which pervades the whole of their personality, that their actions are governed by this mental disease and that therefore they should be treated as patients in a mental hospital and not executed as murderers.

With the passage of time these McNaughton rules have been found more and more unsatisfactory. We now approach more and more the French axiom: "A man is already sufficiently punished by his madness."

This custom is now being followed in New South Wales. Here it is the custom to send prisoners who appear to be insane, to the Observation Wards at Long Bay, where they are examined. If they are insane, they are certified and sent to a mental hospital. This is a step in the right direction. It does



not go far enough. I am convinced that there are prisoners now serving sentences who are insane. I have seen patients with long police records, who have been primary dementals for years and their disease has never been recognized. There is an imperative need to submit every prisoner to a mental examination. Only in this way can insane prisoners be recognized and treated. The care of insane prisoners, their hope of reformation, the means of preventing irresponsible dementals from preying again and again on the community lie not in the rigid discipline of gaol, but in the treatment and understanding of a mental hospital.

As the importance of insanity in prisoners is becoming more recognized, the courts are beginning to insist that those who give evidence in regard to a prisoner's mental condition, must be by training and by experience expert in mental diseases. It is becoming increasingly appreciated that psychiatry is a science and that only those who have studied it as a science, are competent to say whether a prisoner is insane or not. It is true that in many cases alienists of equal eminence will give diametrically opposed opinions about the same case. But we must remember that the borderland between sanity and insanity is often so vague and indefinite that experts with the same facts before them will arrive at totally opposed opinions. So it is in all sciences; so is it in other and more exact branches of medicine.

#### Psychiatry and the Sane Prisoner.

In America psychiatrists have sought to reform prisoners by a complete and thorough psychological examination. The ideal attempted is to understand thoroughly the prisoner's psychology and if possible to correct vicious trends. Thus the victim of bad surroundings is often reformed when provided for in a better environment. Psycho-analysis has been used and some brilliant results have been claimed, especially in the victims of sexual perversions as the *voyeurs*. In children's courts, especially, have beneficial results been claimed.<sup>(2)</sup>

#### Conclusion.

It is now recognized that the understanding of crime lies not in theories, as in the now discredited Lombroso theories, but in a minute examination of each and every prisoner. Some prisoners are mentally defective and should be treated in colonies. Other prisoners have recognizable mental diseases and therefore they should not be treated as prisoners in gaols, but as patients in mental hospitals. Again many sane prisoners can be reformed by a full psychological examination and by the correction of vicious psychological trends.

#### References.

- <sup>(1)</sup> L. M. Terman: "Measurement of Intelligence," 1919.
- <sup>(2)</sup> H. Devine: *The Medical Annual*, 1926, page 108.
- <sup>(3)</sup> W. H. B. Stoddart: "Mind and Its Diseases," Fourth Edition, 1921, page 501.
- <sup>(4)</sup> W. H. B. Stoddart: *Ibidem*, page 254.
- <sup>(5)</sup> W. H. B. Stoddart: *Ibidem*, page 563.
- <sup>(6)</sup> Based chiefly on the views expressed by W. C. Sullivan in "Crime and Insanity."

#### DELINQUENCY.

By ST. LEGER H. GRIBBEN, M.D., B.S. (Edinburgh),  
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THE subject of delinquency is such a very wide one that it is difficult in a paper of this sort to know from which aspect to approach it and in any case in the time at one's disposal it is possible only to touch the veriest fringe of what is one of the most fascinating subjects of this particular branch of medicine.

As you know, great advances have been made in the older countries and a much wider and more sympathetic outlook has been established in dealing with offenders against the law. The modern tendency is in the direction of cooperation amongst those who have to do with the criminal from the time of his arrest until the time when on his discharge the society which is dealing with the matter of returning him to civil life, comes to his aid. The history of this movement has been a most interesting one, but I have no time to enter into the details of it at this stage. However, one of the factors of modern progress has been the increasingly important positions allotted to the medical officers in charge of prisons. In England at the present time all the larger prisons have resident medical officers, while the Borstal Institute at Rochester, the chief of its kind in England, has a medical man as the administrative head. That the importance of a knowledge of the offender's mental standard is recognized in estimating the degree of his responsibility is further evidenced by a resolution which was passed at the International Prisons Congress in England last year, to the effect that every person convicted of a crime should be medically examined before sentence is passed.

The study of delinquency affords in perhaps its most fascinating form a display of those two old-time causative adversities, heredity and environment, and the more one sees of the subject, the more does one tend to agree with the man who in discussing these two conditions declared that: "Environment knocks heredity into a cocked hat." That there is definite subnormality in a proportion of these persons no one will deny, but on the other hand many are highly intelligent individuals, as was clearly evidenced in recent intelligence tests carried out on a considerable scale in America. Furthermore, Mercier pointed out years ago that from the point of view of the expert criminal his profession was really a sound one commercially in that carefully carried out the risk of detection and punishment was disproportionate to the prospect of gain.

Speaking very broadly the three essential factors which it seems to me make for success in dealing with the delinquent are: classification, individualization and a practical knowledge of the criminal mind and outlook. The call for classification is so well recognized that I need not comment on it. Perhaps the importance of an individual study of

delinquents is actually greater, while it is only a knowledge of the outlook engendered by the delinquent's circumstances which will insure sympathetic treatment, a knowledge of when to be firm and when to concede, matters of the utmost importance in handling members of this class.

The question of criminal reform has of recent years been much before the public and all sorts of quick routes and short cuts to this end have been devised and suggested, naturally by people without practical knowledge of the subject. After all, the criminal is human and the greatest incentive to reform is the realization that it will pay him to do so and the ambition with the increase in his self-respect to take a place in the social scale above that in which he has previously moved. Probably one of the most interesting moves in the direction of reformation has been the establishment of the "honour system." I had the advantage of being associated with an institution where this system was put into practice and the results were highly encouraging. I am sorry that time does not permit me to deal in more intimate detail with this aspect of the matter which is destined I am sure to take a prominent place in the future. The essential factor of the system is, of course, the trusting of the inmates in an institution. In addition there is the provision of greater amenities and educational facilities in their daily life, the encouragement of efficiency and good behaviour and what is after all the greatest reward that can be offered, the prospect of a remission of sentence. At the same time it is essential that there should be no relaxation. It must be borne in mind that it is the absence of discipline in the individual's environment which contributes as much as anything else to his falling under the displeasure of the law. It must be remembered that with a class from whom a considerable proportion of the criminal population is recruited, the degree of an individual's skill is estimated by his success in evading detection when he has broken the law. When those who have been brought up under these conditions, arrive in an institution to serve a sentence, the first essential is that they should realize that they cannot in their parlance "put it across the authorities." To those under sentence discipline and firmness are absolutely essential. As days go on and the outlook of the individual becomes more that of the normal citizen, privileges are increased and restrictions relaxed, each case being dealt with on its own merits. I regret that time does not permit of my going more deeply into this line of treatment which I am sure is destined to achieve great results.

One of the main obstacles in the way of reform is the difficulty in arousing public interest in the lot of the offender after he has been discharged from prison. In this connexion it is impossible to praise too highly that small but devoted and indomitable band of workers who are engaged in easing the way back to civil life of those who have been unfortunate, often enough through no fault of their own, when their heredity or environment is considered, to fall under the ban of the law, who have fully expiated

their crime, and are in many cases ready and anxious to make a fresh start. When the public is thoroughly aroused to a sense of its responsibility in this matter, we shall indeed have made a long step towards the greatly desired goal of prison reform.

#### COMBINED MEETING—SECTIONS II, IV AND XII.

##### DIAGNOSTIC TESTS IN HYDATID DISEASE.

By C. H. KELLAWAY, M.C., M.D., M.S., M.R.C.P. (London),  
*Director of the Walter and Eliza Hall Institute,*  
*Melbourne.*

IN the diagnosis of hydatid disease in man there are now many aids at our disposal. Apart from the recognition of hooklets or membrane in material coughed up or voided by the patient, the occurrence of otherwise unexplained eosinophilia or the appearance of well-defined and unmistakable shadows in the skiagram, the immunological reaction of the patient to the parasite furnishes us with useful positive information. These immunological aspects of hydatid infestation have for some five years past occupied the attention of several workers at the Walter and Eliza Hall Institute and I propose to outline their work briefly and to discuss the value of the serological and skin tests in the light of our present knowledge.

The complement fixation test was first applied by Ghedini<sup>(1)</sup> in 1907 to the diagnosis of hydatid disease and knowledge concerning it was much advanced by Weinberg<sup>(2)</sup> in 1909. In Australia the most notable contribution to the subject has been that of N. H. Fairley<sup>(3)</sup> who in 1922 presented his findings in eighty-three patients with hydatid disease. In seventy of these (84%) the test yielded a positive result, while in 917 patients in whom there was no clinical evidence of hydatid disease, no reactions were obtained. In his hands the test was absolutely specific, syphilitic serum and that obtained from patients with other helminthic infestations giving no pseudopositive reactions.

Of the patients with hydatid disease in whom no reaction was obtained, some Fairley was able to show failed to react on account of insufficient absorption of antigen, some on account of deficient antigenic power of the cyst fluid and one at least on account of failure of the defensive mechanism in the elaboration of antibody. Some of these results occurred in patients during the first two decades of life when failure to react to the test is much less significant than at later ages, since the older the cyst, the more opportunity there has been for complications to occur. The location of the parasite did not appear to exert much influence on the immunological response of the patient. Fairley found, as had Weinberg, that operation, rupture, suppuration or death and degeneration of the parasite increased the titre of antibody in the patient's serum and when they occurred might convert a negative into a positive result. In uncomplicated cysts 75%, after rupture 92% and with suppuration 100% of

positive serological reactions were obtained. He found that after operation in the course of twelve months the titre of the serum usually diminished and that the presence of a strong reaction at this period or later was nearly always indicative of a recurrent or residual cyst. If in the course of a few months the serological tests ceased to give a reaction, the chance of persistent infestation was remote and an optimistic prognosis might be given.

Fairley pointed out that in hydatid disease affecting the central nervous system the serum frequently failed to react and emphasized the value of testing the cerebro-spinal fluid in these cases and of applying the test to pleural and other effusions in suspected cases of hydatid elsewhere.

Since Fairley's paper was published our experience has confirmed these findings. In 1923 H. R. Dew analysed some of the results of tests carried out by Miss F. E. Williams at the Institute during the preceding year. Taking Fairley's cases with their own they found that of 169 patients in whom no previous operation had been performed and from whom no history suggestive of earlier hydatid disease had been obtained, 81% gave positive results which were confirmed at operation. The group of thirty patients who did not yield a reaction, included ten in whom the cysts were degenerating, fibrotic or calcareous or in whom there had been long-standing suppuration, six in children and six with uncomplicated cysts of the lung. Of the remaining eight some were in bone or muscle in which Fairley had remarked less intense and less frequent reactions than in hydatids elsewhere. The failure to react in lung hydatid was referred by Dew and Williams<sup>(4)</sup> to the earlier diagnosis of cysts in this region and to the infrequency of daughter cyst formation, which Dew<sup>(5)</sup> in a later paper has clearly associated with injury to the parasite. These results, therefore, depend rather on the absence of complications than directly upon the site of the parasite.

Since N. H. Fairley finished his work in 1922 some hundreds of tests have been carried out by Miss Williams on patients with hydatid disease scattered all over Victoria. Dr. K. D. Fairley is at present engaged in analysing the whole of this material.

The technique which is now in use at the Walter and Eliza Hall Institute, is with very slight modifications that introduced by N. H. Fairley (1922). The test is carried out as follows:

Washed sheep's corpuscles are made up in 3% suspension and sensitized by the addition of from three to five minimum hæmolytic doses of anti-sheep hæmolysin with subsequent incubation for half an hour at 37° C. This mixture is kept on ice till required. The serum to be tested is diluted on the day of the test with four times its volume of 0.85% saline solution and inactivated by heating to 55.5° C. for twenty minutes. Pleural or peritoneal exudates are treated in the same way, but cerebro-

spinal fluid is tested undiluted and unheated. The minimum hæmolytic dose of complement is determined whenever the test is performed. In the test the number of units of complement are varied and are two, three and four in rows I., II. and III., an arrangement which is particularly useful if the hydatid fluid has any slight hæmolytic power in the presence of complement, as is sometimes the case. The arrangement of the system for the final test is seen in the subjoined table.

TABLE I.

Reagents.	Row I.	Row II.	Row III.	Row IV.
Antigen .. .. .	c.cm. 0.15	c.cm. 0.15	c.cm. 0.15	c.cm. 0.15
Patient's serum .. .. . (diluted 1 in 5)	0.1	0.1	0.1	0.1
Complement .. .. . (Row I., II., IV., 0.1 c.cm. = 2 m.h.d.) (Row III., 0.1 c.cm. = 4 m.h.d.)	0.1	0.15	0.1	0.1
Saline Solution (0.85%)..	0.05	—	0.05	0.2

m.h.d. = minimum hæmolytic dose.

After incubation for one hour at 37° C. 0.1 cubic centimetre of the suspension of sensitized sheep corpuscles is added. Controls are always used; several sera known to have no power to react and a hydatid serum known to yield a reaction are put up at the same time as the sera to be tested. Row IV. serves to control any anticomplementary tendency of the serum.

Miss Williams uses the ice-box technique in addition, with three, four and a half and six units of complement in tubes I., II. and III. This further test is slightly more sensitive and often gives decisive reactions in those cases in which there is a partial hæmolysis in row I. only to the ordinary test. These larger doses of complement are advantageous if the sera are at all anti-complementary.

Dr. N. H. Fairley had found that pooled, fresh, sterile fluid from cysts of the liver and lungs of sheep was the best antigen for use in this test, though saline extracts of scolices were also satisfactory. Patterson and Williams subsequently introduced a new antigen, an alcoholic extract of scolices which had the advantage of being stable. Used in suitable dilutions it was specific and did not give any fixation with syphilitic and other non-reacting sera. Dr. Bryce, Miss Williams and I found that it was of no value as an antigen for the precipitin test and that it elicited a much weaker intradermal skin reaction in sensitive subjects than did filtered hydatid fluid. Experiments with isolated uteri of guinea pigs yielded no positive evidence that it could function as an anaphylactic antigen. Furthermore preparations made in the Commonwealth Serum Laboratory gave in other hands some pseudopositive reactions, though such samples as were tested at the Institute were satisfactory when sufficiently diluted.

The precipitin test was applied to the investigation of hydatid cases by Fleig and Lisbonne<sup>(6)</sup> in



1907. In Australia, Welsh, Chapman and Storey<sup>(7)</sup> in 1909 were the first to use it. In 1923 K. D. Fairley<sup>(8)</sup> described a simple precipitin reaction in which hydatid fluid from cysts in sheep with the addition of carbolic acid to make a strength of 0.45% was used. This antigen was not only stable, but inhibited the growth of bacteria while the test was in progress and permitted readings to be made after thirty to thirty-six hours at room temperature.

Filtered hydatid fluid from sheep and fluid obtained from human cysts were not so useful as antigens. Fairley found that equal amounts of undiluted serum and carbolized hydatid fluid gave the maximum precipitation, but that inactivation of the serum by heating to 56° C. abolished the reaction, so that the test could not be speeded up by carrying it out at 55° C. as is usual with precipitin tests. In sixty-two cases of proved infestation the results obtained by this test agreed closely with those of complement fixation and in Fairley's hands gave over 80% of positive results. The only difficulty lies in the interpretation of those tests in which there is no precipitate at the bottom of the tubes, but only a diffuse granularity visible with a hand lens.

Dr. Bryce, Miss Williams and I<sup>(9)</sup> made a further study of this reaction and found that hydatid precipitin began to deteriorate at 50° C. and was completely inactivated after heating for half an hour at 60° C. It could not then be reactivated by the addition of fresh guinea pig serum, but could inhibit the activity of unheated precipitating serum presumably by uniting with the antigen. Hydatid precipitin appeared to resemble other precipitins save for the low temperature at which inactivation took place. We also attempted to produce passive sensitiveness in guinea pigs by injecting precipitating serum, but found, as had other workers, that this phenomenon was much more irregular than the production of active sensitization by the injection of fresh hydatid fluid.

In 1911 Casoni<sup>(10)</sup> described a skin reaction which followed the intradermal injection into infested patients of 0.5 cubic centimetre of filtered carbolized hydatid fluid. K. D. Fairley used this test also in his investigations, but like most other observers regarded the erythema and induration which occurs some hours after the injection as the characteristic features of a positive reaction. In sixty-seven proved cases of hydatid disease he obtained forty reactions. During the first few days after operative interference with the cyst no reaction was obtained and this was also the case where rupture or suppuration had occurred.

Ithurrat<sup>(11)</sup> in 1922 first drew attention to the importance of the wheal which occurs in nearly all hydatid cases within a few minutes after the injection and when Dew at the last Congress presented the results of work at the Walter and Eliza Hall Institute we had already independently come to similar conclusions. It is the absence of this early phase of the reaction which accounts for the failure

to obtain reactions recorded by many of the earlier workers after operation, rupture or suppuration.

Dr. Dew with Miss Williams and myself<sup>(12)</sup> in 1925 described in some detail our results with this test which was carried out by injecting intradermally 0.2 cubic centimetre of filtered hydatid fluid from the cysts of sheep. A wheal eight millimetres in diameter is caused by the injection, which when no reaction ensues quickly fades away as does the wheal resulting from a control injection of saline solution which is made into the skin about ten centimetres distant.

In a typical reaction the wheal caused by the injection of hydatid fluid becomes surrounded by a zone of active erythema, enlarges, often by putting out pseudopodial outrunners and may reach five centimetres in diameter. Occasionally in very sensitive patients other wheals may come up in the vicinity, but in such cases an immediate intramuscular injection of one cubic centimetre of 1 in 1,000 adrenalin is advisable to abort any general reaction such as has occurred in two cases in our experience. The wheal reaches its maximum size in five to fifteen minutes and then fades either within a few minutes or in the course of an hour or so. Its place is taken by an area of erythema round the site of the injection with deep induration due to subcutaneous oedema. This delayed reaction varies greatly in its time of onset, in its extent and in its duration. It may appear simultaneously with the wheal, but more often it gradually develops and reaches its maximum after a period of eight to twelve hours. It may last from twenty-four to seventy-two hours. There is some itching and a sensation of heat and weight in the limb. In some cases almost the whole of the limb becomes hot and red with extensive diffuse induration and oedema of the subcutaneous tissues and the condition may simulate cellulitis, except for the absence of tenderness and enlargement of the regional lymphatic glands and the slight degree of associated general disturbance. Care is needed in cases of jaundice, pruritus, dermatographism or general skin disease and in patients with abnormal sensitiveness to foreign protein to avoid mistaking pseudopositive for genuine reactions.

In patients with uncomplicated cysts as a general rule both an immediate and a delayed reaction were obtained, whereas in cases complicated by suppuration or rupture there was usually only an immediate reaction. The absence of the delayed response could not invariably be attributed to the protective action of circulating antibody since in some cases none could be demonstrated by complement fixation. When both phases of the skin reaction were present, the serum had a low titre of antibody as judged by complement fixation tests. In a small group of patients with residual or recurrent cysts the delayed reaction was absent, though shortly after operation in cured patients it appeared and was often still present after ten years or more had elapsed.

The variety of the immunological response to hydatid infestation was well illustrated by a series



of five patients operated on by Dew whose condition was intensively studied before and after operation, but uncertainty as to the presence of multiple infestation and incomplete knowledge concerning the conditions affecting absorption of antigen made it difficult to interpret the results.

I was, however, able to sensitize myself by a series of four subcutaneous injections of hydatid fluid at intervals of three days. The fourth injection caused some local reaction after twelve hours and an intradermal skin test on the same day gave an immediate wheal, but no delayed reaction. Two days later the intradermal test showed both phases. The serum fixed four minimum hemolytic doses of complement, but there was no reaction to the precipitin test. On the twelfth day the immediate response was well developed and the delayed reaction twenty-four hours later very severe, but on the following day the delayed reaction was less evident and neither the complement fixation nor precipitin reactions were obtained. On the eighteenth day the delayed reaction could still be evoked, but was much less extensive and by the thirtieth day it could no longer be elicited. That the subcutaneous tissues were still sensitive to a larger dose was shown on the thirty-third day by the subcutaneous injection of one cubic centimetre of hydatid fluid. There was an evident reaction within eight hours which persisted for three days. On the fortieth day the primary wheal in response to an intradermal injection was larger than on any previous occasion, but no delayed reaction was obtained. After the lapse of more than a year the immediate reaction is still constantly elicited, though it is not so extensive as previously and after eight hours there is usually a small area of subcutaneous oedema. These experiments suggest that the type of response in which only the immediate wheal is obtained, is a phase in the development of sensitization and in the course of desensitization. The immediate type of response cannot readily be abolished by antianaphylaxis nor can the presence of a large amount of circulating antibody prevent the appearance of the wheal, since we are dealing with the effect of a relatively massive dose of antigen upon capillary endothelium, the injection being confined to the skin and being under a certain degree of pressure. Any small amount of circulating antibody present in the area is swamped by the excess of antigen.

In the case of the delayed response a much more extensive area is affected and it might be anticipated that if the effect were directly anaphylactic, it would only occur when the circulating antibody was small in amount and when there was no constant leak of antigen into the circulation. The most pronounced reactions would then be found in patients long after operation when time had been afforded for the antibody to disappear from the circulation, while remaining fixed to the body cells.

Summarizing the knowledge which we have gained concerning these tests, let us see how their use may help us in the diagnosis of hydatid disease. In the

very early stage of hydatid infestation, the stage of the early follicle or small actively growing cyst, the only test which is likely to yield a reaction, is the intradermal skin test which may give the delayed as well as the immediate response. There may also be some eosinophilia. At a later stage when there is a large uncomplicated cyst with intact laminated membrane and thickened adventitia, there is as a rule no eosinophilia, but except in rare cases when the fluid in the cyst is of low antigenic power, both phases of the skin reaction are observed.

Both Dévé and Dew have shown that the formation of daughter cysts is the result of some accident to the cyst. In these cases large quantities of fluid have been absorbed through the adventitia after rupture or injury to the laminated membrane of the mother cyst. Eosinophilia may be present, there may be a reaction to the complement fixation test and often a high titre of antibody may be revealed. The Casoni test may for some time after the accident give only an immediate wheal, though later both phases of the skin reaction may be found.

In cases with rupture or suppuration these processes may be quiet, with continued absorption of antigen over long periods, or sudden, giving rise to antianaphylactic phenomena due to the outpouring of antigen. Complement fixation is usually positive and indicates a high titre of circulating antibody. The intradermal test may fail to elicit a reaction, though the appearance of the immediate wheal without any delayed response is the common finding. After some months when the absorption of antigen has greatly decreased, both the immediate and the delayed reactions occur.

Finally when death of the parasite or cure by operation has occurred, the amount of complement fixation may be small or there may be no reaction to the test, while the result of the Casoni test is both immediate and delayed for some years, the delayed response usually being lost first.

The Casoni test is of but little value in cases in which there is a previous history of hydatid infestation, but invaluable in early and uncomplicated cases. In complicated cysts or in cases where recurrence or residual cysts are suspected, the complement fixation test is of the greatest value. The simple precipitin test observed by K. D. Fairley should be useful where laboratory conveniences are not available for complement fixation.

The greatest difficulties in interpreting the results of these tests are caused by the frequency of multiple infestation and the occurrence of those fortunately rare cysts whose fluid contents have only very low antigenic powers. In these cases there may be no response to the immunological tests, in the first group owing to complete desensitization and in the second to failure of the production of antibody.

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PROFESSOR C. E. HERCUS (Dunedin) dealt with certain legislative suggestions. He pointed out that hydatid disease was notifiable in New Zealand, but was not in Australia. He suggested with the concurrence of the meeting that a proposal should be put before the final meeting of Congress that legislation should be introduced in Australia to make hydatid disease notifiable and that there should be stricter attention paid to notification in New Zealand. He further suggested that there should be greater control of slaughter houses, especially in regard to the boiling of offal and the exclusion of dogs. Public propaganda should be promulgated as much as possible. On registration of dogs full information should be given as to the importance and prevalence of the disease and the mode of infection. The importance of vermifuges should be made clear especially to those of the farming community.

#### X RAY IN RELATION TO ECHINOCOCCUS.

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##### Intrathoracic Hydatid Cysts.

THE diagnosis of intrathoracic hydatid disease by X ray examination has been definitely established over a long period of years, while in the abdominal region the diagnosis depended on the undue elevation of the right diaphragm, really an intrathoracic observation.

The site for intrathoracic hydatid cysts is most commonly the lower part of the lung field and there may be one or more cysts present.

Unruptured cysts cast a uniformly dense shadow, with an unusually sharp outline which is always

circular or slightly elliptical. The size may be surprisingly large and is rarely less than that of a small orange.

The ruptured cyst, as described by the late Herschel Harris,<sup>(1)</sup> may present MacCormick's sign, "that is the shape of Dutch cheese with the top sliced off and as the patient is tilted from side to side, the upper level remains horizontal and collapsed cysts present a hazy, crinkled appearance."

The escaped fluid may produce an irregular patch of dullness in some part of or towards one edge of which a portion of the cyst wall with its characteristic crescentic sharp outline may be identified.

A dead cyst may become calcified, when there will be a distinct increase in the density in whole or part of its border.

The X ray findings are as a rule very characteristic, but occasionally one meets other conditions which closely simulate the hydatid picture. Calcification may occur in the pericardial sac and present a circular outline very similar to that of a calcified hydatid cyst. A larger and more difficult class still is that of secondary malignant tumour and here it is absolutely necessary to correlate the clinical examination and the clinical tests for hydatids with the X ray evidence. It has to be remembered that hydatid disease may coexist with malignant disease or other pathological conditions. Secondary lung carcinoma may present an almost identical circular shadow, though the outline usually has some slight variations and the dullness is not uniform.

##### Intraabdominal Echinococcus.

In the abdominal region on account of the lack of radiographic contrast the signs of hydatid disease are much more difficult to detect. Help may be sought in this direction by inducing pneumoperitoneum, but the method is not without risk, otherwise we can directly diagnose hydatid only when the cyst is dead and calcified.

Indirect findings depend on the displacement of organs. The right side of the diaphragm may be and often is extremely elevated by cysts in the liver. There is a pitfall here caused by a boss-like protuberance of the mesial half of the right diaphragm, which is sometimes met with, and is caused by a separation of its central tendinous part.<sup>(2)</sup> An elevation of the left diaphragm may be caused by a cyst of the spleen.<sup>(3)</sup> The use of the barium meal in this connexion sometimes reveals deformation of the hollow viscera, due to pressure from a cyst growing in a neighbouring organ. Hydatid cysts of the kidney rarely become calcified, the irregular calcification seen in this region being usually attributed to tuberculous lesions.

##### Therapeutic Use of X Rays.

Experimental work shows that the larvæ can be destroyed by X rays.<sup>(4)(5)(6)</sup> This has a bearing on transplantation following operation. But the dose required is the massive one of a deep therapy cancer treatment. This practically precludes its use in the usual site, the liver, on account of the risk of damaging this organ and the suprarenals.

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## SURGICAL ASPECTS OF HYDATID DISEASE.

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I HAVE nothing new to say about the treatment of hydatids. My experience which is of past conditions, has like that of other surgeons been published from time to time and become common property. It may, however, serve as an introduction to the remarks of those who will place before us the results of the most recent experience and research, to give a brief historical *résumé* of the subject. In so doing an indication will also be given of my personal experience and opinions.

The subject of hydatid was first brought to my notice in 1878, when attending lectures on comparative anatomy. I asked a senior student for some information about the bladder-worm stage in man and he suggested I should see a patient about to be operated on at the Melbourne Hospital. The case proved to be a large cyst of the liver. The surgeon in charge, Mr. T. N. Fitzgerald, had some time previously inserted about a dozen harelip pins in a circle through the skin and into the cyst. At the operation I saw, he plunged a very large trochar and cannula through the centre of this circle into the cyst. Fluid and daughter cysts escaped and the cannula was left in, fixed with adhesive plaster, to drain the cavity. During the whole of my connexion with the hospital as student and resident medical officer up to 1883 that patient continued to attend, discharging cysts and pus. During that period tapping or occasionally aspiration and the method just described were the recognized forms of treatment at the Melbourne Hospital. I saw many cases supposed to be cured by such methods and also some that ended fatally.

In 1879 Lindemann published an account of a case, operated on in 1871, by the method known by his name. The diagnosis had not been made prior to operation. An abdominal tumour was so tense that spontaneous rupture appeared imminent. To

anticipate this an incision was made into it and hydatid cysts escaped. Lindemann sutured the edges of the opening in the sac to the parietal incision and drained the cavity. In 1877 Saenger independently described a similar method, but Lindemann was the first actually to operate.

In *The Medical Times and Gazette* of November 16, 1878, Mr. Knowsley Thornton recorded a case, the first, of multiple abdominal hydatid treated by abdominal section without drainage. One bunch of cysts was attached to the parietal peritoneum and was opened by the incision; a second bunch was at the bottom of the pouch of Douglas and was extirpated; a third bunch was treated by ligaturing off and removing the portion of omentum containing the cysts. The patient made an excellent recovery.

In the *Australian Medical Journal* of May, 1880, was recorded a case in which I saw Mr. T. N. Fitzgerald operate. A very large abdominal tumour had been diagnosed as ovarian. The cyst proved to be a hydatid, adherent to the parietal peritoneum, to the omentum and transverse colon and growing from the left lobe of the liver to which it was attached by a pedicle. The cyst was freed, withdrawn from the abdomen and removed entire, except for the pedicle. This was secured by passing harelip pins through the abdominal walls, transfixing the pedicle and pins were also passed superficially through the stump of the pedicle only and a ligature tied round it under these pins. The abdomen was closed without drainage. The pedicle gradually sloughed away and the patient made a good recovery. This operation, like that of Lindemann, was quite unpremeditated. In an article contributed to Heath's "Dictionary of Practical Surgery" and written in 1884, Mr. Fitzgerald classified the treatment of hydatids into four divisions, one of which was "abdominal section and removal of the cyst entire" for "large movable cysts containing daughter cysts."

In *The Medical Times and Gazette* for January 27, 1883, Mr. Thornton described a second case of hydatid with calcareous walls which he emptied and then "sewed up the whole opening in the cyst into the abdominal incision and closed it up entirely, without introducing a drain of any kind." The cyst had been originally diagnosed as ovarian and occurred in a pregnant woman who made a good recovery.

In 1885 Dr. Gardner and other Adelaide surgeons began operating systematically by Lindemann's method. At the Melbourne Congress in 1889 they made good their contention that it was the method of election, rather than that of tapping, which had up to then been the generally adopted treatment in Sydney, Melbourne and elsewhere in Australia.

In *The British Medical Journal* of April 11, 1891, Mr. C. J. Bond recommended "that certain abdominal cysts can be treated by incision and replacement of the cysts, provided the cavity be thoroughly evacuated and the inverted edges of the incision sutured, to prevent subsequent entrance of a coil



of intestine," and he said further: "I see no reason why we should not deal with cysts in the liver and other organs in the same way, provided suppuration had not occurred." It may be noted, however, that in the case he actually recorded he did not carry out this procedure of suturing the inverted edges.

At a discussion at the Victorian Branch of the British Medical Association reported in the *Australasian Medical Gazette* of December, 1894, I advocated Bond's method and referred to a recent case of hydatid in the pelvis under the care of Dr. Rothwell Adam in which at my suggestion this method was carried out with complete success.

The *Intercolonial Quarterly Journal* of May, 1895, contained a contribution by Mr. Hamilton Russell in which on purely theoretical grounds he advanced the following propositions in regard to the treatment of a single, uncomplicated cyst of the liver: "(1) Drainage is unnecessary and positively harmful; (2) the ectocyst should, after removal of its contents, be dropped back into the abdomen; (3) the opening in the cyst should not be sutured; (4) the ectocyst should not be anchored by sutures or other means to the abdominal wall before complete closure of the abdominal wound." (It should be noted that by "ectocyst" Mr. Russell meant what is generally called the pericyst or adventitia.) Mr. Russell maintained that a flow of serous fluid from this pericyst would be prevented by intra-abdominal pressure and that what might escape would be absorbed without harm and he also maintained that the same applied to escape of bile.

Mr. Russell's arguments so impressed several of the surgeons at the Melbourne Hospitals, especially Dr. Charles Ryan, Dr. W. Moore and myself, that we practised the method in several cases. Dr. Ryan wrote in the *Australasian Medical Gazette* of August, 1895, that "the method had changed the whole aspect of hydatid of the abdomen." I was not quite so enthusiastic. In the *Australasian Medical Gazette* of October, 1895, was reported a discussion at the Victorian Branch of the British Medical Association in which I stated that the views as to what happened when a cyst in the liver was dropped back unsutured, after emptying its contents and the abdomen closed, were quite theoretical and the actual facts were not so far sufficient to permit of dogmatism. I exhibited to the meeting a patient on whom I had operated by Mr. Russell's method for a large liver cyst full of daughter cysts. Twelve days after operation bile escaped from the abdominal incision and discharged for five days. The opening then closed and the patient recovered. In the same number of the *Australasian Medical Gazette* Dr. Ryan himself recorded a case in which bile similarly escaped eight days after an operation by the same method, the patient recovering. In the *Australasian Medical Journal* of September, 1895, was recorded a case which ended fatally after operation by Russell's method on a large non-suppurating hydatid of the left lobe of the liver. The notes of the *post mortem* examination showed the presence

of general peritonitis and "the sac cavity left after removal of the cyst lay at the back of the abdomen, the edges of the incision in it showed no signs of union to each other or to other structures; the cyst cavity communicated with the peritoneal cavity and contained blood-stained fluid, which did not completely fill it; no pus was present."

As a result of these and other experiences I concluded that Mr. Russell's method could not be safely adopted in all cases. It appeared that intra-abdominal pressure would not prevent the escape of serous discharge or of bile. I continued to use the method, however, reserving it for small cysts which could be completely cleaned and I attached the pericyst to the abdominal incision, if possible, so that the cavity could be easily reopened and drained if the patient's condition did not seem satisfactory. In several cases when this had been deemed advisable, it was found that drainage was generally required for a few days only and did not much delay the closure of the wound and complete recovery of the patient.

When a hydatid cyst has been treated without drainage and the condition of the patient is not satisfactory, the possibility of another cyst being present and suppurating must be borne in mind. I once reopened a closed cyst of the liver and could find no accumulation to account for the symptoms. A careful examination revealed a cyst in the spleen which when opened was found to be suppurating. It was drained and the symptoms subsided.

At the Brisbane Congress in 1899 Dr. J. Ramsay advocated anchoring the pericyst to the abdominal incision and in the discussion that followed his and other papers on hydatid, Mr. Russell astonished the members by saying that "he did not think so highly of the method associated with his name as others did and did not feel it was a proper method in cysts in the liver and some other situations," chiefly, apparently, because of the risk of escape of bile.

In the *Intercolonial Medical Journal* of October, 1907, Mr. Russell published a very notable paper, with records of two cases. In one a large hydatid of the liver had become infected and was drained, death occurred from hæmorrhage, a slough opening up a branch of the hepatic vein. In the next case, a large suppurating cyst in the liver, he closed the incision in the pericyst, filled the closed cavity with normal saline solution and closed the abdomen without drainage. He considered that the pressure of the saline solution in the closed cavity would tend to prevent the escape of bile or so much dilute it as to render it innocuous and it might also tend to prevent hæmorrhage and that sepsis and sloughing might be obviated. The patient did remarkably well. In a clinical lecture, republished in his "Papers and Addresses in Surgery," 1923, Mr. Russell stated: "The method of immediate closure after filling with saline fluid, while not universally applicable, is, I believe, when carried out with reasonable care and precaution, safer and better than any other method known to me."



With this statement on the whole I agree. I have carried out this method in a number of cases with success, but I have always anchored the cyst, if practicable, to the abdominal incision and have had occasion to reopen and drain. One case in which this had to be done, illustrated a mistake I made. The cyst was a very large one in the upper surface of the left lobe, pushing up the diaphragm as high as the fourth rib. Although an X ray examination had been made, I did not see the skiagram and made my incision over the greatest dullness to percussion. After reopening and draining it was found that the cavity kept filling up because, as shown by a skiagram, it was below the level of the incision and did not empty, but simply overflowed. Had it not been anchored it would have dropped away from the parietal incision altogether.

The occurrence of severe hæmorrhage at the time of or subsequent to operation is one of the most serious, though fortunately rare, risks of operations in hydatids. I have had two cases in which death occurred from this cause, in one actually on the operation table, resulting in an unpleasant coronial inquiry. A previous abdominal operation had been performed for multiple hydatids in the liver by Russell's method. Many cysts were left for subsequent operation. As they appeared to be chiefly on the upper surface they were approached through the thorax at the second operation. When the diaphragm was incised, although the upper surface of the liver bulged up, the actual cyst did not present. An exploring needle was introduced and drew off hydatid fluid at a depth of about nineteen millimetres (three-quarters of an inch). A knife was passed along the needle into the cyst and a most alarming hæmorrhage followed. I rapidly passed stirrup sutures into the edges of the liver and tied them and then drew up the liver and plugged the cavity, but could not arrest the bleeding and the patient suddenly collapsed and died. At the *post mortem* examination the whole liver was one mass of cysts, the portion incised being practically the only liver tissue left, and in it the hepatic veins were enormously dilated and one of these had been divided in the incision. The other case was a very large cyst on the posterior surface of the liver towards the mid-line and was approached through the thorax. On evacuating it the most terrific hæmorrhage I have ever seen occurred. It was apparently arrested with gauze plugging and the patient removed to her room, but she died very shortly afterwards. The *post mortem* examination showed that the cyst had eroded the inferior *vena cava* as it lay in its groove on the posterior surface of the liver.

I have also seen severe, though not fatal, hæmorrhages in operations on deeply placed pulmonary cysts which had evidently opened a blood vessel by absorption, but the pressure of the cyst was sufficient to close the opening until lowered by evacuation. In the same way an opening may be made into a bronchus, which may be of a valvular nature, and kept closed until the cyst is evacuated.

A dramatically alarming occurrence is the sudden communication of a cyst with a bronchus when the cyst is aspirated, the patient being nearly suffocated by the entry of fluid or membrane into the air passages. Often the aspiration is done for a supposed pleural effusion which is really a hydatid of the lung. I was once urgently summoned to see a case in which this had happened. As I drove up to the house the attending practitioner met me and said: "You are too late, he is dying." I found the patient cold, livid and practically pulseless, gasping for breath and violently coughing. I rapidly plunged a knife between the ribs, where the aspirator puncture was and into the cyst. Hydatid fluid poured out, a tube was inserted, the patient was relieved and ultimately recovered.

Difference of opinion exists as to the operative treatment of pulmonary hydatids both before and after rupture. While I have treated several cases without drainage, I have generally had to reopen and put in a drain, usually for a few days only. I have never seen emphysema as a result of this operation, but it does occur and except in very small sterile cysts I think it is safer to drain. In cases of ruptured cysts it is sometimes very difficult to decide whether to operate or not. On the whole I am inclined to be conservative. It is imperative to have a good stereoscopic skiagram showing the exact situation and extent of the cyst. If it is found to be definite, of fair size and near the chest wall and the patient is distressed by the frequent cough and seems to be losing ground and especially if large pieces of membrane are being expectorated which might occlude the glottis, operation is indicated. I use a galvano-cautery knife to incise the lung. It dries up the lung tissue, checks oozing of blood and sterilizes the parts cut which are often infected from the air passages. When the skiagram shows the cyst to be very deeply situated and does not give a defined shadow and if the patient has had hæmoptysis, it is generally safer not to operate, but every case has to be decided on its individual merits.

Some difference of opinion exists as to the best approach for hydatid cysts situated low down in the pelvis, between the bladder and rectum in the male. At the Brisbane Congress in 1899 Dr. Moore advocated the abdominal route, evacuation of the cyst and closure without drainage. I agreed with him then and still agree. But Dr. Moore stated that in some cases and certainly in suppurating cases the perineal approach was preferable. Mr. Fred. Bird advocates a suprapubic cystostomy and evacuation and drainage through the bladder and has recorded successful results by this method. It appealed to me so little, however, that in a case in which the bladder was opened suprapubically, to investigate an obscure retention of urine which proved to be due to a hydatid, I closed the bladder and attacked the cyst from the perineum. It was packed with gelatinous daughter cysts and had calcareous walls. A curious feature of this case was that the cyst communicated with the prostatic

urethra and long after the perineal incision had healed, small particles of calcareous material have several times made their way through the urethra and been passed or have lodged and been extracted by urethral instrumentation or by incision in the perineum, a skiagram showing extensive calcification of the remaining pericyst.

Hydatid of bone has in my experience been very difficult to eradicate, because the cysts are so numerous and infiltrate the cancellous tissue so extensively. Operation after operation may be required, with extensive chiselling and curetting of the bone. The symptoms are often so obscure at first that the nature of the disease is not recognized until it has spread widely in the bone. At the Annual Meeting of the British Medical Association at Belfast in 1909, I reported several unusual cases of hydatid in bone, illustrating the difficulties both of diagnosis and treatment. It is most important to make an early diagnosis and skiagrams should be taken in all vague bone and joint cases, especially in children and young adults.

From what is known regarding the rate of growth of hydatid it would appear that a very considerable number of infestations must occur in childhood and become recognizable later.

Dévé maintains that: "Echinococcus is a disease of early life" and is then "simple and uncomplicated." Hydatid of the brain occurs seven times as frequently in children as in adults. In the brain hydatid cysts produce recognizable symptoms earlier and are operated on or cause death before adult life is reached. In other parts they can go on slowly enlarging without producing symptoms. Of hydatid of the brain I have no personal experience. The question here as in the lung is "to drain or not to drain." Patients have recovered and patients have died under each method. On the whole the best results seem to have been attained by a two-stage operation and temporary drainage.

The possibility of disseminating hydatids during operation has long been recognized. Dévé since 1901 has specially emphasized the danger of post-operative recurrence and recommended injecting the cyst cavity with "Formalin" before emptying it. The President of this Congress, in his admirable paper on hydatids at the Auckland Congress in 1914, strongly advocated this procedure. In Melbourne, the President of this Section, Mr. B. Kilvington, has practised it extensively and has used very strong solutions up to 20% and has also left as much as 45 cubic centimetres of a 10% solution in the closed cavity. I have used formalization for some years, but I confess I am a little afraid of using strong solutions and of leaving it in a closed cavity. Fatal cases have been recorded from its use. Ever since I have been operating, I have taken very scrupulous precautions to prevent dissemination at the time of operation. The method I adopted, was to pack round the exposed cyst with gauze packs and to cover the edges of the incision and adjacent skin with packs and towels in the usual way and then to cover all of these with a

protective having a slit or aperture in it corresponding to the incision and fixed with towel clips to the skin. Over this again is placed dry gauze, also fixed with clips. The cyst is then aspirated and as it empties and becomes a little flaccid, it is grasped with a volsellum and withdrawn as far as possible through the incision. More gauze is packed round and the cyst incised and the edges of the incision seized with Lane's tissue forceps and as the cyst empties, it is more and more withdrawn, if it will come. The gauze down to the protective is frequently changed as it becomes soiled with fluid and cysts. The contents are sucked out with a suction apparatus and the cyst can generally be quite emptied and dried. I agree with Mr. Stewart McKay's remarks at the last Congress that by these or similar methods it is possible to prevent dissemination. Formalization before the cyst is opened is not always possible if the cyst is tightly packed with daughter cysts, especially when degenerated into a gelatinous or putty-like mass. If it can be done it is an additional safeguard, provided the "Formalin" solution is subsequently washed out. Perhaps I am too conservative, but I never liked taking unnecessary risks.

To sum up, the ideal treatment consists in completely extirpating the parasitic cyst with its contents and pericyst entire, closing the incision without drainage. The ideal, however, is seldom attainable and while the surgeon should aim at the ideal, he should not make up his mind beforehand to carry it out regardless of consequences. The operative technique may be ideal and be perfectly carried out, but the patient may suffer unnecessarily and even die as a result of it. The surgeon must be always prepared to modify his methods according to circumstances, of which in the case of hydatid cysts the chief are the age of the cyst and its anatomical situation. The older the cyst, as a rule, the more difficult the ideal technique will be and to attempt it may be dangerous. It may generally be adopted in cysts situated in the omentum (care being taken in multiple cysts not to do too much), in the mesentery and in the subperitoneal and other connective tissues, except bone. If the cyst and pericyst cannot be extirpated, the ideal is to remove the parasite and close the incision without drainage. For cysts in the spleen and kidney Bond's operation is generally applicable and is the operation of election and also for very small cysts in the liver. For most hepatic cysts, however, Russell's method of filling the closed cavity with saline fluid and closing the abdomen without drainage should be the operation of choice and may be carried out even if the cyst be infected. I prefer to anchor the cyst wall as well. While drainage should be avoided, if possible, in most lung cysts it is safer to drain.

As a general rule the cyst should be formalized before emptying, but it is not essential and it is safer not to leave a "Formalin" solution in a closed cavity. Every case of hydatid must be considered individually and dealt with according to circumstances and the judgement of the surgeon.

NOVEMBER 19, 1927.

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Dr. H. T. D. ACLAND (Christchurch) dealt with the use of formaldehyde in the attempt to destroy the parasite. He asked Sir George Syme whether he regarded it as safe to formalize the peritoneal cavity.

MR. HAMILTON RUSSELL (Melbourne) stated that formalin introduced into the sac exerted a lethal effect on the scolices, whereas a saline solution had a purely mechanical effect. The ideal to aim at was to kill the hydatid. He discussed the question of treatment of a patient with a large hydatid cyst who was jaundiced, had pain and a temperature of 40° C.; after the cyst had been opened, a slimy, gelatinous, bile-stained material escaped. He suggested that the cyst should be thoroughly washed with sodium chloride solution and closed. He had drained one of these cysts and later the patient had died. Another patient he had treated as above and he was practically well the next morning. He had come to the conclusion that the flow of bile stopped on account of the mechanical pressure of the salt solution in the cyst and that when the pressure became equalized, the bile ceased to flow, so that a little later the contents of the pericyst consisted of salt solution with a little bile; nothing further happened and the fluid became absorbed. Another point about the injection of saline solution was that any small hole towards the posterior part of the cyst was displayed on account of the pouring out of the solution from the cyst into the abdominal cavity.

MR. GORDON CRAIG (Sydney) agreed with Mr. Hamilton Russell on the physical basis of the use of saline solution. He mentioned the work of Dévé and Harold Dew; by the injection of hydatid fluid they had been able to produce hydatid in any part of the body they desired. He himself used alcohol as a means of destroying the hydatid. He admitted that there was grave danger of leakage from the cyst and suggested that where suppuration followed marsupialization and drainage, the hydatid was killed possibly by the suppurative process. After withdrawing a portion of the hydatid fluid from a cyst, he injected pure alcohol and then cleaned up the cyst mechanically and inserted a drain. The first part of the discharge was serous, but later hydatid fluid might appear. This he attributed to a secondary smaller cyst bursting into the main cavity. He referred to Sir George Syme's good advice that no hard and fast rule could be laid down in regard to the treatment. He spoke of the importance of the germinal layer of the cyst.

DR. L. E. BARNETT (Dunedin) stated that with regard to the ectocyst its importance had not been sufficiently recognized. If its vitality or tone were damaged or interfered with, daughter cysts formed and osmosis was altered; the result clinically was a change in the response to the Casoni and complement fixation tests. The latter depended on the integrity of the ectocyst. With regard to the X ray diagnosis he considered that the use of such substances as "Lipiodol" was not justified. He stated that in the Argentine and Uruguay government propaganda was active and laws were very strict, but this had failed to stop the disease amongst the illiterate people of the country districts; in the towns the disease was on the decrease. In Australasia they should be careful not to become slack regarding the question. It should be made a penal offence to throw raw offal to dogs. He warned surgeons not to attempt to remove a partly pedunculated cyst on account of the danger of a very serious hæmorrhage occurring from the liver in the region of the attached portion. It was not wise to leave formalin solution in the sac; formalin was of no use when daughter cysts were present. In these cases he removed the daughter cysts and swabbed out the cavity with formalin. The importance of formalin was that the scolices were killed by a 1% solution of formaldehyde in five minutes. The same experimental evidence was not patent with regard to the killing effect of alcohol on the scolices. He considered that surgeons should hesitate about operating for a pulmonary cyst if it were deeply placed; the mortality rate was very high and a great many of the patients cured themselves spontaneously by evacuation. Suppurating cysts were being treated with great frequency without drainage. The infection was of a low grade type and many of the patients were cured. The pendulum was tending to swing back to drainage of suppurative cysts. Cysts with rigid calcareous walls which did not collapse,

formed one of the bugbears of surgery. Cauliflower excrescences often grew into the interior of the cyst and microscopically these appeared to be really growths from the ectocyst.

In conclusion Dr. Barnett referred to the exhibit in the preventive medicine museum. He stated that the placards were not up to date as they still conveyed the idea that hydatid disease was largely water-borne, whereas in the majority of cases infection was usually by direct contact with dogs.

SIR GEORGE SYME in reply referred to recurrences in the skin and liver; if in the latter he considered that it was due to the condition which Mr. Gordon Craig referred to, namely a small cyst discharging into the main cyst after operation. In the old days when tapping was common, there was often a fresh serous discharge for the first few days and later a flow of hydatid fluid which was a point in favour of Mr. Craig's explanation. In reply to Dr. Acland as to whether it was safe to formalize the peritoneal cavity, he could not give any information. He stated that he had not known of a case of reinfection after the abdomen had been swabbed. He stated that formalization of a cavity must take place prior to evacuation of the contents, as the risk of reinfection occurred during operation. Loculated cysts were certainly very difficult to clean out. The best method of procedure was to enlarge the incision and to mop out the cavity under the direct vision of a head light or an electric lamp actually placed inside the cavity. The theory of growth of daughter cysts was that it was in inverse ratio to the density of the tissue. In bone, for instance, there would be a multiplicity of cysts, whereas in soft tissue such as the brain there would be very few. He agreed with Dr. Barnett as to the low infectivity of suppurating cysts and that was the reason why it was possible to deal with them as suggested by Mr. Hamilton Russell. In spite of what Dr. Barnett said about the difficulty of treating calcareous cysts, he had often removed a considerable amount of the wall without any serious hæmorrhage taking place.

MR. GORDON CRAIG emphasized the fact that he injected alcohol prior to evacuating the contents of the cyst.

#### COMBINED MEETING.—SECTIONS IV AND V.

#### THE CONTROL OF HOOKWORM IN A NATIVE COMMUNITY.

By T. RUSSELL RITCHIE, M.B., B.S., D.P.H. (New Zealand),  
Chief Health Officer, Samoa.

The large amount of work which has been carried out during recent years in the investigation of the problems involved in the control of hookworm, has clearly proved that such control is not a matter of a special campaign or two, but of many years of supervision, education and treatment of the inhabitants of the area to be dealt with. Special campaigns by well-trained campaigners give prominence to the seriousness of the disease and to the necessity for adequate sanitation and treatment. But resurveys of many areas some years after the campaign have shown that the tendency is for the areas to revert more or less gradually to their original condition, unless such campaign is succeeded by properly organized public health activities.

The policy which has been and is being pursued in Western Samoa to bring about the control and perhaps in time to come the eradication of hookworm disease in those islands, may be of interest to you, as showing what is being done in one of the many island groups of the Pacific.



In Western Samoa we have a population of nearly 42,000, including 38,000 natives, 1,000 Chinese, 2,500 Europeans, mostly of mixed descent, and 150 Solomon Island labourers. The natives are a well-behaved, quiet, intelligent and conservative race, living in 170 villages spread over 270 miles of coast. There are very few inland villages. The villages vary in size, the largest, Apia, having at the census of January 1, 1926, a population of 956 and the smallest, a village in Savai'i, thirty-four. The average population per village is in Upolu, 223 and in Savai'i 204. More than half the population is under eighteen years of age and 16% are under four years. It is worthy of note in connexion with the future prospects of improvement in the health of the community that 31% of the natives are attending school.

Until the beginning of 1923 the natives had to pay a small charge for medical attention and this rendered it impossible to institute systematic measures for the control of hookworm, unless such measures were placed on a different footing from the other activities of the medical department. At that time the most obvious condition requiring attention and the one treatment of which would do most towards gaining the confidence of the natives in western medicine was yaws. Practically no child reached adult life without having suffered from this condition which usually appeared towards the end of the first year of life. When, therefore, towards the end of 1922 the natives proposed that a medical levy of one pound a year be imposed on all adult males and free medical treatment be given, our first concern was to commence systematic treatment of this disease throughout the territory. At the same time in one area a medical officer carried out the line of campaign against hookworm which we had decided upon, based on the work of the Rockefeller Foundation in Australia and various island groups in the South Pacific, with very satisfactory results. The experiences of this officer in his district were published in *The New Zealand Medical Journal* at the time.

Two non-medical members of the staff, a dispenser and an inspector of health, were then trained in this work and sent out to cover different districts. Their procedure was as follows: Each night a lecture illustrated with lantern slides was given on the village green and early next morning the whole population was treated. Later, when we had solved the difficulty of a portable cinema machine, the film "Unhooking the Hookworm" was shown in the villages.

Mass treatment was given, as investigations in 1920 by Dr. O'Connor, of the London School of Hygiene and Tropical Medicine, had shown that over 90% of the population harboured this parasite.

This systematic treatment of the population has been continued each year since 1923, everyone being given the opportunity of having treatment at least once a year.

The other aspects of the work of control are inseparably connected with the usual activities of a health service and also with those of other depart-

ments, such as education, native affairs, agriculture and so forth. Perhaps the most important factor is the position held by the women in the native communities. In Samoa, as amongst many native races, the women take a very secondary place, somewhat similar to that held by our own womenfolk before they enlightened us as to their right to a "place in the sun." As most of the ordinary domestic activities, as well as much of the plantation work, were in the sphere of women's operations, it was considered that more rapid advance would be made if the women could be interested in our work. Women's committees were therefore formed in every village and various duties assigned to them. By means of articles in the monthly Government paper which is distributed to all heads of families and by personal visits from the two lady medical officers, these women were shown how they could make their villages cleaner and healthier, how to bring up their children and how to treat the minor ailments so common amongst the children. Simple drugs were issued to them with instructions and practical demonstrations in their use. As an instance of the beneficial results accruing from this policy, conjunctivitis which was very common only a few years ago, is now rarely seen and the prevalence of minor skin conditions has been greatly reduced. These women are now awakening to the fact that the larger civic questions, such as the provision of pure and adequate water supplies, the remodeling of villages, the provision of playing areas and the like are of as much interest to them as to the men. This awakening of the women to a realization of the position they should occupy in the social structure is full of promise for the future.

That the women of Samoa are well fitted to play their part is demonstrated by the success attending our training of native girls as nurses. These girls undergo a course of training at Apia Hospital and are then sent to take charge of dispensaries in out districts. No better testimonial to their usefulness could be obtained than the keen desire of those districts not yet provided with dispensaries to have them opened. But the supply of suitable girls depends on the various government and mission schools and as the educational facilities in Samoa are rapidly improving, there should be no lack of suitable applicants in the future.

By arrangement with the Government of Fiji suitable Samoan boys are now being sent to Suva for training as "native medical practitioners."

As has already been mentioned, 31% of the population attend school. The lower grade schools and a few higher schools are under the control of the missions, but the administration is rapidly extending its activities in education. A school journal in Samoan for use in all schools is published three times a year. In every journal is an article on hygiene supplied by the medical department and thus we are getting hold of the younger generation and moulding them in the right direction.

From the administrator who never tires of using his influence in the furtherance of our work and the officials of other departments in close touch with



the natives we receive a great deal of help. The Agricultural Department inspectors who amongst their other duties see that villages and their plantations are kept clean and undergrowth cut down; the Public Works Department who plan the remodelling of villages and the Native Department which is in touch with all native affairs, are all by their activities cooperating in our work. The missions are also of great assistance, their influence being given whole heartedly in the furtherance of our policy.

I seem to have strayed from the subject under discussion, but it is most important in the case of hookworm that the general education of the community should proceed hand in hand with our activities.

Only a few years ago native sanitation did not exist in Western Samoa. The latrine was the beach, usually at or above high water mark, or the undergrowth in close proximity to the houses. This does not mean that the Samoan was not cleanly in his habits; he was, in fact, much more particular as to cleanliness of his body, clothes and house than many amongst so-called civilized races; but the importance of proper disposal of excremental matter had never been shown to him. Under the conditions prevailing at that time it was not surprising to find hookworm infestation practically universal. That the degree of individual infestation was comparatively light was probably due to various factors, of which the following are a few. Nearly all the villages are on the coast and therefore the tides would wash away much of the faecal matter deposited in the vicinity of high water mark; the torrential rains in summer would wash away much of that deposited above high tide or in the vicinity of the villages and in winter the long dry spell would be unsuitable for the development of larvæ. Another factor which may have contributed to the low individual degree of infestation, was the presence of large numbers of fowls, in the crops of which many larvæ must have been destroyed. Other factors must also have been at play, but whatever the determining factor or factors, a condition of equilibrium apparently existed, the gains and losses in the average hookworm population being counterbalanced.

In an interesting though somewhat speculative discussion on the factors that influence the rate of increase of hookworm infection (*American Journal of Hygiene*, Volume V., No. 6) Sawyer defines the measure of equilibrium of intensity as being the average number of hookworms per person before control operations, with corrections for changes in sanitation, season and so forth.

In a small area in Western Samoa, Hopkins, using the Clayton Lane method of egg counting, found in 333 natives an average egg count of 71.8 eggs per cubic centimetre per person. Smillie and Augustine in their classification of individuals into six groups according to differing intensities of infection, suggest that where an egg count shows 1 to 599 eggs per gramme of faeces, the number of worms will be 1 to 25 and the infection "very light."

These figures indicate that the average infection with hookworm in Western Samoa is a light one.

With the commencement of our hookworm control work the question of the type or types of latrines to be installed had to be decided. At that time water carriage disposal was not practicable and the pan privy was out of the question, owing to the very strong disinclination of the Samoan towards the removal and disposal of faeces.

In villages close to those portions of the coast protected by coral reefs the solution was the erection of "drop latrines" over the sea and large numbers of these were built within a very short time of the commencement of our campaign.

Though most of them were unsightly, they served their purpose and were an indication of the changed attitude of the Samoans as a result of our propaganda. These will eventually be replaced by more sightly structures of a permanent nature or will be abandoned for water carriage systems in those areas where piped water supplies become available. In those villages where the coast was exposed to the open sea and in the village located at a distance from the coast pit privies were installed. There is yet to be invented a fly proof pit privy which is also proof against the thoughtless and the mischievous.

In a few villages the problem of latrine accommodation is a very difficult one. Sea latrines are out of the question owing to the unprotected nature of the coast; pit privies cannot be dug owing to the lava being close to or on the surface; pan privies the Samoans would not use for reasons already given; water is not available for a water carriage system. The installation of pan privies could, of course, be enforced, but it would be a case of "You can take a horse to the water . . . ."

In many districts gravitation water supplies are possible and in several the Samoans have already through their recently established district councils levied rates on themselves to finance such undertakings. Where the supply of water is ample, water carriage disposal of excremental material will be possible. Where the system has been tried in three institutions in Apia, the hospital, the Government schools and a large residential girls' college owned by the London Missionary Society, it has been found to work satisfactorily where there is proper supervision. Without supervision, blockages quickly and frequently occur through the use of stones and cocoanut husk instead of paper. Probably when such systems are installed in native villages, ignorance and carelessness will result in frequent blockages, but experience will soon teach the native that latrines which are given fair treatment, will yield satisfactory service. Again, the Samoan, like many a young New Zealander, will often destroy or damage a mechanical contrivance in his thirst for knowledge as to "how it works." But these difficulties are not insuperable and with adequate supervision and training of the native there is no reason why this method of disposal should not become established. At the present time, however, it is advisable to adopt a "go-slow" policy.

The treatment of hookworm is not yet on a sound scientific basis. Until a few years ago the value of a drug as an anthelmintic and its dosage were based on clinical experience, with no research work or very little to prove its efficacy. The history of the popular hookworm remedies of to-day clearly indicates this. Male fern, thymol and oil of chenopodium were all introduced about 1881. Of these, male fern is now not heard of in hookworm treatment: thymol became the popular drug and held its position until a dozen years ago, when it was replaced in favour by chenopodium. This drug, introduced into Europe from Brazil in 1881, was adversely reported on and came into favour only about 1913, forty years after its introduction. From that date it was largely used all over the world, until in 1921 Hall introduced carbon tetrachloride. Introduced in 1904  $\beta$  naphthol is still used by some, but it is inferior to the last three mentioned.

The number of drugs in use and the lack of unanimity as to their relative efficiency, safety and so forth clearly indicates that the ideal drug has yet to be discovered. Such ideal drug must combine maximum efficiency with safety, palatability, ease of administration and cheapness.

But those of us who are entrusted with the care of natives, of whom the greater percentage suffer from hookworm, cannot await the discovery of this ideal drug. We have, therefore, to work with the drugs at our disposal and in our choice of drugs must consider all the circumstances. To the physician in a European community where this disease is infrequently met with, such considerations as palatability, ease of administration and cost do not arise. He is concerned solely with the questions of efficacy and safety. But where mass treatment of large numbers of natives has to be carried out, these matters are of importance.

The question of which drug should be used in Samoa, was chiefly determined by the work of the Rockefeller Foundation and the successful results obtained by Lambert with carbon tetrachloride in his campaign in Fiji. The dose given by Lambert was four cubic centimetres, but as a few deaths (believed to be due to impure drug) had occurred by the time we were ready to commence work, we decided to make the adult dose three cubic centimetres. In 1924 we commenced using a mixture of carbon tetrachloride three parts, oil of chenopodium one part, the dose being 0.12 mls (two minims) per year of age, with a maximum dose of two mls (thirty-five minims). The drug was given with a dose of Epsom salts, except during the first year, when the Epsom salts were given after the drug. The change was made owing to the prevalence of *Ascaris lumbricoides* in Samoa, a parasite on which carbon tetrachloride has no effect.

Since the commencement of our campaign late in 1923, we have given over 40,000 treatments, without any known fatal results.

There is in this paper no record of any original research carried out by the medical staff in Samoa. There is one medical officer to every five or six thousand inhabitants and our first duty is to remedy

as far as possible those conditions which take the greatest toll of the community, either in lives or in suffering. To this all our energies are at present directed and until it has been accomplished, we cannot afford either time or money or divert the activities of our staff. That we had and still have a great deal of leeway to make up, will be evident from the fact that until 1921 the only institution for treatment of the sick by trained personnel was in Apia and of sanitation there was none.

#### TREMATODE INFESTATIONS IN NORTHERN MELANESIA.

By R. W. CILENTO, M.D., B.S., D.T.M. and H.,  
Director of Public Health, Territory of New Guinea.

TREMATODE parasites of man in the tropics and elsewhere include some exceedingly dangerous varieties and Australasia is fortunate, so far as records go, in being almost free of such.

The area preeminently infested with these parasites is the Orient, where *Fasciolopsis buskii*, *Clonorchis sinensis*, *Opisthorchis felinus*, *Heterophyes heterophyes*, *Loxotrema ovatum* (*Metagonimus yokogawai*), *Paragonimus ringeri* (*westermanii*) and *Schistosoma japonicum* are all more or less common. Some, indeed, occur nowhere else as common parasites.

Oceania has known many ancient and modern invasions and immigrations from Indo-Malaya and the Orient and the fact that a very considerable proportion of all the plant and insect life of Northern Melanesia is from these sources, while the inhabitants themselves are a hybrid race derived from Papuo-Melanesian stocks with an infusion of Oceanic mongol blood suggests the probability that trematode parasites would have had easy entrance here and suitable soil for endemic continuance.

On the contrary, exceedingly few have been found, however, and in no case to my knowledge had trematode parasites been found in natives up to a short time ago, though some few cases had been seen in Chinese. It had almost come to be regarded as proven that there was no extension of trematode infestation to these islands, no endemic trematode disease and probably (though the question had not been investigated) that no intermediary host existed locally for most of these diseases.

These conclusions have been rudely upset by the discovery several weeks ago of paragonimiasis in a native recently recruited from a distant and rarely visited native village, a village indeed only visited three times by white men, so far as is known and until 1924 not shown on the district maps.

There are several significant points in this discovery:

- (i) The disease is a dangerous one.
- (ii) This is the first recorded occurrence of the disease (in a native) in any territory south of the Philippines, except Sumatra.
- (iii) The native patient came from a little visited area, indicating that the disease is locally endemic.

(iv) Since he had never been away from his village there must be effective intermediary hosts for paragonimiasis in the Territory of New Guinea.

That the disease is a dangerous one, figures readily show; Clayton Lane and Low<sup>(1)</sup> place paragonimiasis first among the three trematode infestations (other than hæmal) producing grave effects; Manson-Bahr<sup>(2)</sup> states that in "many of the endemic districts a notable percentage of the population is affected"; since recovery is rare, though immediate danger is unusual, the disease obviously assumes considerable importance.

With regard to distribution authorities note the occurrence of the parasite commonly in China, Korea, Japan, Formosa and the Philippines; Castellani and Chalmers state<sup>(3)</sup> that the infection "is more prevalent among people living along large rivers, according to Nakagawa and less so among people who use well-water."

The case above (recorded by Cilento and Backhouse in THE MEDICAL JOURNAL OF AUSTRALIA, January 15, 1927, page 79) is, so far as is known, the first found in the Pacific anywhere south of the equator and as a matter of fact the patient came from a village situated not far from the sea, upon a fresh water river rising on the slopes of Mount Taungi (latitude about 4-50°S., longitude about 152° E.).

The disease manifests itself in various ways. The onset is insidious and a chronic cough is common, usually most urgent on rising in the morning. There is rusty brown sputum which can be produced at will and the synonymic name "endemic hæmoptysis" serves to emphasize the irregular attacks of hæmoptysis to which the patient is liable. Broncho-pneumonia or bronchiectasis are sometimes seen, bronchitis and peribronchitis very commonly. Abdominal pain and diarrhoea often arise with a rigid abdominal muscular wall, while symptoms of cirrhosis of the liver, appendicitis, prostatitis, epididymitis and adenitis have been recorded.

Occasionally an aberrant collection of the parasites infests the brain, especially in children, causing a peculiar Jacksonian epilepsy with the possible accompaniment of hemiplegia, aphasia, visual disturbances, pareses or monoplegias of various degrees.

Generalized lymphadenitis (especially axillary and inguinal) occurs commonly in chronic cases and cutaneous lesions are also seen.

The course is prolonged and no means for expelling the parasite from the lungs has been discovered. Infections with tubercle bacilli are common, the damaged lung offering a favourable site for the implantation of the bacilli. General septicæmia or pyæmia may follow purulent foci in the lungs or other viscera.

It is doubtful whether spontaneous recovery ever occurs. If the lesions be not severe, life may not be unduly shortened, but the possibility of septic sequelæ must always be borne in mind. Acute cases with speedy death have been recorded. When complicated with tubercle the prognosis is bad and when the brain is affected, it is practically hopeless.<sup>(4)</sup>

The transmission of the disease has been studied by Japanese workers mainly, but their findings as yet are in dispute. The expectorated egg, it is claimed, falling into clean water, at a temperature between 15° and 37°C. produces a ciliated embryo in three to five weeks. It may remain viable and unhatched, however, for as long at least as twenty-three weeks. Workers claim that the intermediary hosts are firstly, certain fresh water snails of the *Melania* species especially *Melania libertina* and *Melania obliquegranosa* and secondly, various crabs and crayfish such as *Potamon obtusipes*, *Potamon dehaanii*, *Sesarma dehaanii*, *Eriocheir japonicum*, *Astacus japonicus*, *Astacus similis* and others.

The optimum definitive host is the pig, the infestation being practically limited among them to the lungs.

In this Territory the local molluscan genera and the crabs and crayfish have not to my knowledge been recorded in any readily available papers. It is obvious, however, as stated above, that if indeed these are the intermediary hosts, the species locally present must be capable in regard to transmission and must be infested to some considerable degree in the local sector from which this patient came, if not elsewhere.

This is a conjecture of a disturbing nature and is important not only for New Britain but for the whole of Melanesia.

It is hoped that members of Congress who are at work in western Samoa and other Polynesian islands, will endeavour to determine whether trematode infestations are locally present in order that measures may be introduced to combat what might otherwise become a menace.

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- <sup>(2)</sup> P. Manson-Bahr: "Manson's Tropical Diseases," eighth edition, 1925, page 550.
- <sup>(3)</sup> A. Castellani and A. K. Chalmers: "Manual of Tropical Medicine," third edition, 1919, page 1,585.
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#### YAWS.

By T. RUSSELL RITCHIE, M.B., B.S., D.P.H. (New Zealand).  
Chief Health Officer, Apia, Samoa.

In the past practically no Samoan child reached the age of two years without contracting yaws and this disease was the cause, both direct and indirect, of much of the mortality occurring during the first few years of life.

That primary and secondary lesions are never seen in adults in Samoa indicates a long period of endemicity.

So universal was the condition in Samoa that the natives considered it a natural condition which must appear early in the life of the child or normal development would not occur. This belief often led to drastic measures being taken to "bring out the



disease" if it did not appear by the time the child was twelve to eighteen months old and from our experience during the past several years, there is no doubt that these measures helped to increase the death rate at that period of life.

This belief was so firmly rooted that when we commenced our intensive campaign in 1923, hardly a child with a primary frambesoma was seen. The fact that injections of "Novarsenobillon" would quickly clear up the condition was well known to them, but they were afraid that unless the generalized secondary eruption was allowed to appear, the treatment would only "drive the disease in," to the detriment of the child's health. Patients with secondary and tertiary lesions were freely brought forward for treatment.

The natives had become acquainted with the value of arsenical preparations in the treatment of yaws, during the German and later the military occupations of Samoa, but no systematic work for the control of the condition was undertaken until 1923. During that year 32,366 injections of "Novarsenobillon" were given, in 1924 21,200, in 1925 12,000, and for the first six months of last year just over 4,000. Each year the whole of the area was investigated and the reduction in the number of treatments given is therefore due to a definite decrease in the number of cases. During August and September last year the most outlying district in the Territory was thoroughly inspected. The population of the area was 3,500 and the number of patients with yaws dealt with was 260, of whom only three were suffering from primary lesions, fifteen from secondary lesions and the remainder from tertiary manifestations.

Our method of procedure in our campaign is as follows: The district to be treated is divided into areas, each of a size, according to topography and population, which can be readily dealt with in five treatment days. Treatment is given at five selected points in the area and on Saturday the party retraces its steps to the point of commencement of treatment. Second and third injections are given at the same points during the second and third weeks. It will be seen that three weeks are spent in covering each area and three injections are given to each patient at intervals of a week. The party then passes on to the next area.

The work carried during 1923 and 1924 so impressed the natives that they agreed to the passing of stringent regulations for the control of this disease. It also had the result of weaning them from the belief that yaws was a necessary evil. The result is that at the present time the natives are as anxious as we are to see all patients treated as quickly as possible after the primary sore appears and although we shall have tertiary manifestations to treat for many years to come, the time cannot now be very far distant when primary and secondary yaws will be practically, if not absolutely, unknown in the Territory.

We do not claim that three injections will cure the condition, but experience has shown that the majority of primary and secondary lesions clear up

with three injections and the percentage of relapses in all stages of the disease is not great. Armstrong, who kept careful records over a period of three years in one district, found fifty-three relapses among 536 patients, a frequency of 10%; eight of these had been given less than the usual dosage owing to other conditions besides yaws being present.

At the present time, however, we are not particularly anxious to cure every patient. Such an aim would probably defeat itself. As all adult Samoans have had yaws in their early youth, they are immune from another attack. To treat them thoroughly for tertiary yaws would be to withdraw that immunity and so to render them liable again to contracting the disease and this would make them look with disfavour on the treatment. Until such time as we have reduced the primary and secondary infections to a negligible number, the acquired immunity of the adult is better left alone. Meanwhile the thousands of children born year after year are growing up free of this condition and as 16% of our population is under four years of age, it will be seen that a fairly large and increasing proportion of our population is free of this disease.

Another consideration which renders us chary of interfering with the acquired immunity of adults is the relationship between yaws and syphilis. What the exact relationship is has not yet been determined, but it is, I think, significant that in the South Pacific, where yaws is rife, syphilis is practically unknown. It is impossible to believe that the early whalers, runaway sailors and convicts who were amongst the first white visitors to these islands, did not bring syphilis with them and so expose the native to risk of infection. We have never seen a case of syphilis in a Samoan and it is very rare in any of the Polynesian groups of islands. Why? Is it that yaws confers some immunity? The fact that syphilis has been given experimentally to a person suffering from yaws, does not prove that such occurs in Nature's laboratory. Under natural conditions such might occur, but the history of Samoa, where yaws was universal and where syphilis must have been introduced time and again, seems to indicate that yaws confers some immunity to syphilis.

If such be the case, then it would be tantamount to a crime to take away this immunity until such time as the more advanced communities in the Pacific have taken steps to eliminate this disease from amongst themselves.

As very few of the children born today contract yaws and as the natural increase in population is over 3% a year, it will not be long before the majority of the inhabitants of Samoa will be non-immune to yaws. By the time these children reach adolescence, the European races, it is to be hoped, will have managed to bring syphilis under control in their communities and at the same time the natives themselves will be more advanced and therefore under better control if such disease should happen to be introduced.



## SECTION I.—MEDICINE.

PROFESSOR C. WITHERINGTON STUMP read a paper on "Blood Formation, a Study of Myelogenesis." This article appears in the current issue of THE MEDICAL JOURNAL OF AUSTRALIA.

DR. S. V. SEWELL (Melbourne) asked Professor Stump how he recognized megaloblasts.

Professor Witherington Stump explained that the erythroblast stage was when both hæmoglobin and the wheel nucleus were apparent; it was a hesitating phase in the red cell series. This type was capable of rapid stimulation into activity.

## THE TREATMENT OF PERNICIOUS ANÆMIA.

By D. E. FENWICK, M.D., M.R.C.P. (London).  
*Honorary Physician, Wellington Hospital.*

I AM afraid that there are few of us who can deny that at any rate until very recently we have approached our patients with pernicious anæmia with a sinking heart and a sense of futility, a feeling that there are certain things to be done and a possible hope of prolonging life; but beneath that feeling a stronger one that sooner or later the inevitable fatal end must come. I think the first essential in the treatment of pernicious anæmia is the abolition of this pessimism. It is unhealthy and not conducive to success in treatment. There is much work yet to be done before we can speak freely of actual cures, but there is no doubt that even in the light of our present knowledge we are fully justified in banishing the word incurable from its association with the disease.

The difficulty is in deciding what is a cure and what is a long remission. Here I would like to refer very briefly to the nature of the disease. It is neither desirable nor possible to discuss theories in the time at one's disposal, but I may emphasize these points, that pernicious anæmia is a condition of progressive blood destruction, that this destruction is the work of a hæmolytic toxin, that there is considerable evidence in favour of the view that this toxin is produced in the alimentary canal, though there is little evidence as to the causative organism, and that it is practically certain that the toxæmia causing the disease does not and cannot occur if free hydrochloric acid is secreted by the stomach, the rôle of the acid being that of destroying agent to the organism before it reaches that part of the intestinal canal in which, by its own efforts or by the breaking down of protein, it generates the toxins.

Accepting the evidence that achlorhydria is an essential part of pernicious anæmia, one must count a return of hydrochloric acid secretion in the stomach an essential factor before we may speak of cure.

M. E. Shaw, Medical Registrar of Guy's Hospital, in the Guy's Hospital Reports of July, 1926, details the case of a man suffering from pernicious anæmia, with a blood count of 800,000 red cells, a

colour index of 1.14, the typical cells of pernicious anæmia and a complete achlorhydria, who has remained perfectly well over a period of three years and has regained his normal hydrochloric acid secretion. I shall later quote the case of a patient of my own who has made an apparent recovery but I cannot give the most important statement as to his hydrochloric acid secretion, as the man has for some time been in England. But to my certain knowledge this man has remained perfectly well over a period of three years.

Apart from the hydrochloric acid question, we might ask in respect to this patient whether he has made a recovery or whether he is passing through the stage of a prolonged remission. Maitland Jones gives the average duration of remissions as six months. Figures given previously of anything from three months to four years are open to doubt, because they were made with insufficient data for diagnosis.

I would enumerate the principal forms of treatment as follows:

1. Administration of hydrochloric acid;
2. Treatment of focal sepsis;
3. Administration of arsenic;
4. Blood transfusion.

I propose to refer briefly to each of these measures. In my opinion I have stated them in the order of their importance. I have omitted any reference to rest, diet and hygienic measures not because of their unimportance, but because of time and I have not included splenectomy, because I have had no personal experience with regard to it in this disease and because I have very grave doubts as to its value in cases of true pernicious anæmia.

## Hydrochloric Acid Administration.

The administration of hydrochloric acid should be commenced as soon as the diagnosis is made. Achlorhydria occurs in every case. It is not the result, but occurs before the onset of this disease. Hurst, to whom with his fellow workers at Guy's Hospital we owe so much in connexion with the advances made in the study of this disease, has made a most valuable addition to his previous work in an article published in July of last year, in which he attempts to discover the relative frequency of constitutional *achylia gastrica* and acquired achlorhydria, that is to say, the achlorhydria of alcoholic gastritis, of gastric carcinoma, that following gastrectomy and that which occurs rarely after gastro-enterostomy through the neutralization of the gastric contents by the alkaline juices of the duodenum. The series of cases reported was numerically small. Of them 27% were definitely constitutional, 16% were acquired and the remainder uncertain. It is obvious that this matter is of the very greatest importance, in prognosis at least. One may reasonably assume that there is at least a chance of restoring function in the acquired cases, but one has considerably less hope in the case of congenital *achylia gastrica*.

As regards dosage it is generally agreed that to perform any useful service one must depart entirely

from the old 0.6 to 1.0 mil (ten to fifteen minim) doses. Numerous writers advise starting with small doses and working up to the necessary five to seven mils (one and a half to two drachms) of the dilute hydrochloric acid of the British Pharmacopoeia. Personally, I have found no difficulty in commencing with five mils (a drachm and a half) three times a day, giving it in lemonade, partly before, partly with and partly after each meal. Shaw<sup>(1)</sup> points out that seven mils (two drachms) given by the continuous method, that is in divided doses every quarter of an hour for five doses, is the most accurate means of remedying the defect.

#### Removal of Focal Sepsis.

While there has been a certain amount of animal experimentation showing that a condition similar to pernicious anæmia can be produced by the injection of toxins obtained from streptococci, there is not sufficient evidence to consider the disease a streptococcal infection. Clinically there is considerably more similarity to a protozoal disease. Nevertheless, it is obvious that the removal of all focal sepsis, particularly oral sepsis, is to be desired. I cannot help thinking, however, that in this respect a little over enthusiasm can be and sometimes is shown. The patient with pernicious anæmia is one whose resistance is extraordinarily poor, and who is going to suffer more severely from trauma, shock, infection and loss of blood than other patients. If sepsis is obvious, it must be removed, but it is not justifiable to remove teeth because a patient has pernicious anæmia nor to enucleate tonsils because there is no other obvious focal sepsis to remove. On the other hand I would like to quote one case as an example of the efficacy of removal of sepsis.

E.E.B., a male, aged forty-six years, was admitted to the Wellington Hospital on August 20, 1923. His father had died of pernicious anæmia. The duration of the patient's symptoms was two months. On examination the typical lemon colour of the skin was noted. An examination of the blood revealed that there were 1,300,000 red cells per cubic millimetre, that the hæmoglobin content was 30% and that the colour index was 1.1. Poikilocytosis and polychromasia were noted and there were many megakaryocytes. An examination of gastric contents revealed complete achlorhydria.

This patient was in hospital for two months, during which time he was transfused once, was given dilute hydrochloric acid and arsenic and a septic tooth was removed. No other sepsis was noted. He left hospital at his own request, in order to go to his home in the South Island, his attitude being practically that as there appeared to be no chance of recovery he would prefer to die in his own home. About one month after his return to his home, he had severe toothache and asked his dentist to withdraw the offending tooth. The dentist, though loath to do this, acceded to the request. This tooth proved to be the site of acute apical sepsis and in doing the extraction the dentist appears to have saved the patient's life or at the very least to have prolonged it most serviceably.

The history was given to me by the patient one year from the time of his discharge from hospital. I did not have the opportunity of making a further examination of him, but he told me that he progressed rapidly and uninterruptedly from the date of the second extraction and at the time he spoke to me he had the appearance of as healthy a man

as one could wish to see. To my definite knowledge this man has remained perfectly fit and well up to a few months back, that is, he has remained well for three years. As I have mentioned before I hesitate to say that he is cured. I hope to be in a position to say this when he returns to New Zealand from England, where he is on business. I hope to persuade him to have his gastric juice examined for this purpose. If he is not cured, he has at least had three years of normal healthy life and it appears to be incontestable that the recovery he made was solely due to the removal of sepsis. He had no other treatment after that event.

#### Arsenic.

Arsenic has for many years justifiably been accepted as the best treatment for the anæmia if pernicious anæmia. It is a symptomatic treatment only. Fowler's solution, cacodylate of soda, "Salvarsan" in different forms have all had their enthusiastic advocates. The weight of evidence is that injections of organic compounds of arsenic give no more satisfactory results than arsenic by the mouth. Gulland, at the last annual meeting of the British Medical Association in England made the following statement:

My own experience has convinced me that arsenic given by the mouth is so immensely superior to all the other methods of treatment put together, that every case should have a proper trial of that remedy; and further that cases that will not do with arsenic by the mouth, will seldom respond to arsenic given in any other way.

It seems clear that unless some definite advantages can be shown in favour of other routes of administration, the oral route is to be preferred where treatment has to be continued over long periods. There is little to be said as to dosage. One should commence with small doses and work up rapidly to something about 0.6 mil. (ten minims) three times a day.

#### Blood Transfusion.

If blood transfusion is to do any permanent good in pernicious anæmia it is difficult to see how this can be accomplished except through its effect upon the bone marrow. Unfortunately, much as this effect of transfusion has been discussed, there is no finality of agreement as to it. Whether it be by stimulation, a doubtful desideratum for an already overworked organ, or by nourishment which seems more desirable in the case of exhaustion, or by enabling the marrow to rest temporarily from its feverish activities, is uncertain. The value of transfusion in this disease, as Sir Humphrey Rolleston pointed out in opening the discussion on transfusion at the last annual meeting of the British Medical Association, has been variously estimated. There are many who support it enthusiastically. Others who regard it as a means of obtaining temporary improvement and others who consider it inefficient and dangerous. There can be little doubt that transfusion may be of the greatest value; that there are pernicious anæmia patients today under treatment who could not have been alive but for this measure. Its chief value seems to be in

ting the patient over a critical period in making possible the onset of a remission and in giving time for the institution of other treatment. There seems to be no justification in regarding transfusion as a treatment *per se*.

There are many other questions to be answered regarding transfusion in this disease, particularly what amount of blood should be transfused and how often transfusion should be performed. In 1924, Hurst was advocating small transfusions, twenty-five or thirty cubic centimetres repeated every second day. I have no experience of this and there seem considerable difficulties in the way of its achievement. Personally I have not transfused more often than once a fortnight and I have used 250 to 500 cubic centimetres. But I have not found a patient who did not respond to one transfusion, respond to a second. And as I have said, I have regarded transfusion more as an emergency measure than as a routine treatment. I hope this aspect of treatment will be discussed by other speakers.

#### References.

- ① M. E. Shaw: "Achlorhydria and Hydrochloric Acid Therapy in Addison's (Pernicious) Anæmia," *Quarterly Journal of Medicine*, July, 1924, page 319.

#### BLOOD TRANSFUSION IN PERNICIOUS ANÆMIA.

By D. W. CARMALT JONES, M.D. (Oxon), F.R.C.P. (London),  
Professor of Systematic Medicine, University of Otago,  
New Zealand.

LAST year I went to Australia to discuss the programme of this Congress with the doctors there. A member of the staff of one of the Sydney hospitals told me that he had done much blood transfusion during the war and that on his return to Australia he had set up a resuscitation team for civil practice, which had employed blood transfusion in many cases of pernicious anæmia, to use the commonest name for the disease. He offered to contribute a paper on that method of treatment to this discussion, which I gladly accepted, but he had since found himself unable to attend the Congress.

Sooner than let the discussion of this important therapeutic measure go by default, I volunteered to undertake it myself, as I now find somewhat rashly, for the material at my disposal turns out to be scanty and its record imperfect. This contribution, therefore, is of the slightest, but it will serve to introduce this aspect of the subject and will, perhaps, indicate that transfusion may be regarded as a most important item in the treatment of this disease.

It so happens that the subject came up for discussion at last year's annual meeting of the British Medical Association at Nottingham at a session of the Section of Medicine devoted to blood transfusion in the treatment of disease, which was opened by Sir Humphry Rolleston, with his customary erudition. Professor Gulland dealt more especially with pernicious anæmia and stated very clearly that he regarded arsenic given by the mouth as immensely

superior to all other treatment and positively curative. Blood transfusion, he says, helps a patient round a critical corner and gives him a chance to recover himself, but it is not curative. Dr. Spriggs seemed on the whole to agree and stated that transfusion was the best treatment when arsenic and other methods had failed.

I have searched the records at Dunedin Hospital made during the seven years I have been there and I have found notes of sixteen patients, ten males and six females. Twelve of the patients were between the ages of forty and sixty, with only one below forty, a young man of twenty-seven. Transfusion has gradually come into use during this time. All the patients now considered had typical blood-pictures and suffered from the usual symptoms of the disease which I will not waste time in enumerating.

They, therefore, frequently displayed that characteristic feature of the disease, remission, the spontaneous occurrence of which makes any kind of crucial experiment in its treatment quite impracticable. With the possibility of spontaneous remission it is useless to take a series of patients and then treat alternate ones by any selected method and claim specific value for the results obtained. Again, the degree of severity of the disease at the time of treatment and the consequent prospect of recovery are both extremely variable and are against strict classification of results. In any case, the number of patients at our disposal here is inadequate for any such method of investigation.

The disease is serious and one has no alternative but to employ all means of treatment likely to be of value in every case. These consist in (i) rest, (ii) diet, (iii) removal of obvious septic foci, (iv) hydrochloric acid for the achylia, (v) sometimes a streptococcal vaccine of organisms obtained from the stomach, (vi) arsenic which we generally give as cacodylate of soda and nowadays, (vii) blood transfusion. One's object in treatment, at any rate my object, is to induce a remission.

All one can do in appraising the value of transfusion here is to compare those treated with and without its help and to make the best estimate one can of the results produced, with due recognition of the fallacies just mentioned and of the added difficulty that improvement is often largely subjective and that greatly increased capacity for effort may occur with comparatively small objective increase in the blood count. If there is an improved blood count which is maintained, it constitutes valuable confirmatory evidence.

Of these sixteen patients, five were treated without transfusion and eleven with one or more injections of blood.

Of the five treated without transfusion one was in the terminal stage of subacute combined sclerosis of the spinal cord and died a fortnight after admission. One improved subjectively after ten weeks' treatment, went to a convalescent home, relapsed, was re-admitted and died in seven weeks. One was in hospital for five months, but received what I think we should now regard as inadequate



treatment with arsenic in very small doses and gradually sank and died. Of the two remaining, one was in hospital for five weeks, the blood count improved from one million to two and the patient went out relieved. The other gave one of the striking successes sometimes seen with arsenic; he was sixty years old, was only three weeks in hospital and in that time his blood count increased from 1,600,000 to 3,500,000 per cubic millimetre. If such results can be obtained with arsenic, very good results must be obtained with blood transfusion before claiming special value for it.

The eleven patients transfused show how the method now chiefly followed in the hospital has been arrived at. We generally use the citrate method. I do not propose to discuss the technique nor the detail of blood typing, nor the immediate unpleasant results which sometimes occur, such as shock, rigors, convulsions or hæmaturia. There is no claim that the treatment is without risk.

The first case occurred in 1922, in an old woman of seventy-seven, who had had pallor for ten years and had been bed-ridden for one. She was admitted with uncontrollable hæmorrhage from the rectum, for which, I suppose, the transfusion was given, naturally in this instance without result; the patient died.

Another ineffective transfusion was given in the case of the young patient of twenty-seven, who came in with some acute infection and a high temperature. He died and a *post mortem* examination showed the characteristics of pernicious anæmia.

Four patients had one or two transfusions only, generally large ones of 568 cubic centimetres (twenty ounces) or more: one had such subjective improvement that she had considered herself cured and came back some two years later for a repetition. One improved in his blood count from 1,300,000 to 3,000,000 per cubic millimetre at the time of discharge, improvement has been maintained for a year and the patient considers himself cured. One improved from 2,000,000 to 2,300,000. One was transfused and discharged, readmitted after a month in relapse, was transfused again without improvement and died. This single "hit or miss" method, as we have seen, may come off very well, but I think there are better plans of treatment. The next case shows a kind of transition to the method now employed. The patient was a woman of forty-five who had been ill for four years and definitely pale for one year. She came to the hospital in 1923 and was readmitted about every six months for the next two years, at the end of which she died. She came back definitely for transfusion and generally received a large one of 568 to 700 cubic centimetres (twenty to twenty-five ounces). Whether she took arsenic or not when at home, I do not know, but on one occasion she had less than 1,000,000 red corpuscles per cubic millimetre on readmission and was discharged with 3,000,000 and once she was admitted with 1,800,000 and discharged with 3,600,000 and some signs of affection of the spinal cord disappeared.

A comparable case is that of a woman of sixty-five, whom I showed (or hoped to show) this morn-

ing. She was admitted some two years ago with a blood count of 1,400,000, she was treated without transfusion and kept improved health for a year. She has since been admitted three times at intervals of about six months and has been transfused with slight improvement and increased blood count. She is emphatic that the improvement is very transient and she does not desire further transfusion.

The following is the case which committed me to blood transfusion in the treatment of this condition by the method of repeated small doses. I regret that I cannot remember to whom I am indebted for that suggestion.

A man of sixty was treated at intervals for a year and has been under observation for two years since treatment was stopped. He was treated for a month with arsenic, during which his blood count fell from 1,800,000 to 1,100,000 per cubic millimetre. He then had a weekly transfusion of 284 cubic centimetres (ten ounces) of blood for three weeks. His blood count rose to 2,000,000 and he was discharged, though still very ill. He was readmitted at intervals of two or four weeks, when his blood count was generally about 1,200,000. He was transfused and discharged. This was continued for six months, when his blood count was 3,500,000. He came back in another two months with a blood count of 5,500,000, no symptoms and the capacity to do as much as any of his contemporaries. He was shown this morning. This is the result which I now aim at in this disease. I assume that a remission has been induced and maintained in this case.

I would like to contrast with this, a case of aplastic anæmia in a man of thirty-four, admitted with a blood count of 2,000,000, with poikilocytosis but no nucleated red corpuscles. He was transfused nine hundred cubic centimetres (thirty-two ounces) and had a fit in the process, followed by rigors and hæmaturia, but still some subjective improvement. I think all anæmia patients who are not actually moribund, from whatever cause, get at least a transient benefit from fresh blood. His blood counts during the ensuing month were 2,300,000, 2,700,000, 2,000,000, 1,100,000 and 900,000. A month later he was transfused 568 cubic centimetres (twenty ounces) without shock, but from that time he steadily went down hill and died in two weeks. *Post mortem* examination revealed aplastic anæmia.

Another patient progressing favourably is still under treatment and was shown today. A man of fifty, admitted in November, 1926, with a blood count of about 1,300,000. Septic teeth were extracted and two transfusions of about 284 cubic centimetres (ten ounces) were given at fortnightly intervals. In a month his blood count was 2,100,000, with subjective improvement much greater than these figures suggest. He went home for Christmas and returned and after another transfusion his blood count went to 2,400,000 and later to 4,200,000.

I will conclude with two cases which illustrate the familiar difficulty in diagnosis between pernicious anæmia and gastric carcinoma.

CASE I.—R., fifty-nine years old, a male, is a chronic dyspeptic, recently jaundiced, with septic teeth, enlarged liver and achlorhydria. He complained of anorexia and loss of weight, with evident pallor and a blood count of 1,600,000 per cubic millimetre.

CASE II.—T., sixty years old, a male, had an enlarged liver and spleen and achlorhydria. He complained of anorexia, abdominal pain and loss of weight; there was much pallor and a blood count of 1,700,000 per cubic millimetre. So far, one would have thought these two quite parallel cases of gastric carcinoma.

The blood pictures in each case, on admission, were as follows:

CASE I, R.: Red blood corpuscles 1,600,000, Hæmoglobin 40%, colour index 1.25. There was anisocytosis, poikilocytosis, polychromatophilia. One normoblast and one megaloblast were found.

CASE II, T.: Red blood corpuscles 1,700,000, hæmoglobin 40%, colour index 1.25. There was anisocytosis, poikilocytosis, polychromatophilia, a few nucleated reds.

Surely equally parallel cases of pernicious anæmia.

The diagnosis was cleared up by transfusion.

R. had 1,600,000 red blood corpuscles on August 4, 1926. On August 25 he received a transfusion of 225 cubic centimetres. On September 14 he received another transfusion of 225 cubic centimetres. On September 24 he was discharged. On November 12, 1926, he wrote that the improvement had been maintained. He was shown this morning.

T. had 1,700,000 red blood corpuscles on September 30, 1926. On October 5, he received a transfusion of 225 cubic centimetres. On October he had 2,000,000 red blood corpuscles. On October 21 he received another transfusion of 568 cubic centimetres. On October 27 he was given a transfusion of 284 cubic centimetres. On October 28 his red blood corpuscles numbered 2,500,000. On November 4, he had 1,700,000 red blood corpuscles and on November 21, 900,000. On November 22 he had a transfusion of 284 cubic centimetres. On November 24 his red blood corpuscles numbered 1,100,000. There was no subjective improvement and he was going down hill. He died on December 16, 1926. The *post mortem* examination revealed carcinoma of the stomach.

My personal conclusion is that the repeated transfusion of small amounts of blood is of the highest value in pernicious anæmia, that except for actually moribund patients it may be counted upon to produce great improvement maintained for considerable periods and that any patient with anæmia not moribund who does not respond in this way, is probably not suffering from pernicious anæmia.

DR. C. R. BURNS (Dunedin) gave an account of the reactions which followed blood transfusion in patients at Dunedin Hospital. In all he had studied the records of one hundred; in fourteen there had been some reaction after transfusion. Of these, seven had suffered from severe and the other seven from mild reactions. Of the seven with severe reactions, two had had sudden symptoms of headache and backache during the transfusion; one of them had died during the transfusion, the other had had hæmoglobinuria on the following day. In the other five the symptoms supervened after removal to the ward. There was some evidence in favour of the reactions in these instances being due to hæmolysis, though he was aware that the opinion of workers in this subject was against that view. The milder reactions took the form of a rise of temperature for one, two or more days. The underlying causes that suggested themselves were impure citrate or mild degrees of hæmolysis. Curiously enough the severe reaction had occurred on each occasion when a donor of the specific type had been selected. Lately they had been using type IV. donors for all and there had been no reaction.

DR. F. BEVAN BROWN (Christchurch) spoke of sudden death that had occurred during the transfusion as a result of sudden overloading of a fatty heart with an increased volume of circulating fluid. The heart had stopped in diastole. Hence small transfusions were recognized to be safer. On the assumption that pernicious anæmia was due to an infection by a streptococcus which lived best in a protein medium, it might be advisable to restrict the nitrogen intake, but here a difficulty arose in that nitrogen was required for restoration of the blood elements. Achlorhydria had not been proven as a necessary precedent of the disease. Since 4% of all persons had a natural achlorhydria, it was a reasonable assumption that the achlorhydria was also secondary to the thing which caused the hæmolysis, this same agent acting on the secreting cells of the stomach.

DR. S. V. SEWELL (Melbourne) asked Dr. Carmalt Jones whether there were megaloblasts or megalocytes in his case of gastric carcinoma. He referred to the clinical history of a patient with extreme pernicious anæmia with an undoubted blood picture, hæmoglobin 25%, red blood count 1,000,000. He had been giving hydrochloric acid and arsenic by mouth with no success. Intravenous injection of "Salvarsan" in alkaline preparation was given with miraculous result. The patient was still alive after fifteen years and was having blood transfusions at frequent intervals. Another patient under his care had lived for six years and was having frequent blood transfusions. These patients had lived longer than any others under his care. He described a case of rapidly progressive anæmia of only three weeks' standing; there were 1,000,000 red blood corpuscles per cubic millimetre. The blood contained megaloblasts with cartwheel network. A blood culture yielded a growth of hæmolytic streptococcus. The patient had been a normal, healthy girl with slightly sore throat. He had given two hundred cubic centimetres of antistreptococcal serum and repeated small transfusions of blood. She had convalesced after two and a half months and had become perfectly well. This was a case apparently of streptococcal septicæmia, but the blood picture would have suggested acute pernicious anæmia.

DR. T. W. J. JOHNSON (Auckland) contended that pernicious anæmia as usually seen was a well advanced condition. He was watching fourteen patients with anæmia which he believed to be early. The signs and symptoms were pallor, languor on exertion, sore tongue and diarrhoea. A test meal revealed an achylia which completed, he believed, the syndrome of early pernicious anæmia. He had instituted a course of hydrochloric acid. In one patient the blood picture had given a slight indication, but only in one. He testified to the value of treatment with acid. One man treated by hydrochloric acid alone had remained well. In his experience transfusion was of considerable benefit to young adults, but of less frequent benefit to those of sixty or so.

Dr. Fenwick could not accept the streptococcus as the basic cause of pernicious anæmia; the position was non-proven, hence he did not see sufficient reason for reduction of protein diet. The weight of evidence both in England and America was in favour of achlorhydria being the precursor of pernicious anæmia. He agreed with Dr. Johnson regarding the symptoms of the early phases of pernicious anæmia. He suggested that there seemed almost to be a familial tendency to the disease. He had examined the other apparently healthy members of families in which there was one member suffering from pernicious anæmia, and had found an achlorhydria. Though this proved nothing, it was suggestive.

Dr. Carmalt Jones stated that there had been numbers of megalocytes in the blood of his patients with gastric carcinoma. There had been no examples of sudden death as far as he knew among the patients whose histories he had been detailing. He had had no experience of treatment by low protein diet in pernicious anæmia. Though he was inclined to follow Hurst in thinking that the long-chained streptococcus was the root cause, he suggested that the infection was grafted on the achlorhydria. He had laid down no specific prescriptions regarding diet.

## SECTION III.—OBSTETRICS AND GYNÆCOLOGY.

## THE TREATMENT OF PROLAPSE.

By A. NORMAN MCARTHUR, M.B., Ch.B. (Melbourne),  
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St. Vincent's Hospital, Melbourne.

DURING the last thirty years there have been many changes in the treatment of what may be called relaxed vaginal outlet. I really am not able to say whether the change in treatment is as great as the change in the condition or whether the relaxed upper parts of the vagina has occurred only recently or was present and not observed thirty years ago.

The longer a gynæcological surgeon pursues his work, the greater will be the impression that much more could have been done to obtain effective repair in what may be called general relaxed vaginal outlet. I claim no originality in what I put forward. The broad lines on which I work, are gradually evolved from the experience of poor results from the older type of perineorrhaphy. These older methods of perineorrhaphy, such as Howard Kelly's, Lawson Tait's, Hurst's and so on, still have their very limited uses, but in the greater majority of cases far more extensive plastic work is necessary to give beneficial results. The cause of the evolution of one's ideas in perineal repair is that quite often the sagging upper wall of vagina still comes down and is nipped in the well repaired perineum, also many patients who have had the perineum repaired elsewhere, have come to me with symptoms as bad as ever and have to subject themselves to the much more extensive operation of colpo-perineorrhaphy which I will describe later.

A few years ago even my operation of colpo-perineorrhaphy was not so extensive and I had to do some form of hysteropexy.

I here quote from my paper appearing in THE MEDICAL JOURNAL OF AUSTRALIA (February 22, 1919) just seven years ago.

For women under sixty-five with *prolapsus genitalia* it is my habit to undertake an extensive anterior colporrhaphy and a very extensive posterior colpo-perineorrhaphy, the abdomen is then opened, the uterus pulled up, that portion of the uterus that comes out beyond the recti muscles is removed, the cervical canal obliterated and the stump of the uterus attached to the under surface of the recti muscles after the peritoneum is sewn round the edge of the stump.

Now I depend entirely on vaginal plastic work. The usual relaxed vaginal outlet now means that high up in the upper reaches of the vagina there is a great ballooning and sagging. This can be readily demonstrated by using the bivalve speculum. The vaginal orifice admits only a comparatively small opening of the speculum, but the extreme ends of the blades may be opened widely and the still sagging vaginal wall obtrudes itself before the cervix. I often meet a two or three fingered vaginal outlet and high up near the cervix a great roomy vagina

capable of containing the whole closed fist in comfort.

I do not remember noticing this condition in my earlier gynæcological career, but in my latter years it obtrudes itself on nearly every occasion. Why? I am gravely suspicious that it is due to the premature use of forceps in childbirth. So much has been made of painless labour in lay journals and medical literature that the public has begun to think that it must be true and if not true, there is a lack of efficiency in dealing with the condition. How many of you have experienced the position when labour comes on, that the patient, the husband, the mother and father and the whole gamut of relatives demand immediate relief to the sufferer?

So many of you have had your hand forced to use forceps at an early stage when, if left alone to digest your early obstetric teaching, you would have left the case to Nature. The effect of application of forceps to the head long before moulding has taken place, long before the ligaments have adjusted themselves to the slow dilating effort of the fetal part is to stretch unduly and destroy the ligaments of the uterus. More than likely in this obstetric hurry the bladder has not been properly emptied. Reviewing the whole situation, I think relaxation of the upper portions of the vagina is more or less a modern trouble resulting from obstetric haste.

Having considered the relaxed vaginal outlet, it is only a little step further when we are brought to the consideration of complete prolapse of the genitalia. The uterus covered by the vagina is projected between the thighs, bringing with it the bladder, the uterus, Douglas's pouch, the tubes and ovaries and the anterior rectal wall. I want to say that this condition is produced by the destruction of the group of so-called uterine ligaments and not merely the result of a badly torn perineum. I have frequently demonstrated this to students when a perineum torn to a third degree has shown no displacement of the uterus and *vice versa* a perineum with a little evidence of destruction and yet complete prolapse of the genitalia nipped in the tightened perineum. Therefore, in discussing any remedial method of this very trying condition one must try to restore the parts as nearly as possible to a normal standard. The greater number of patients with relaxed vagina require an anterior colporrhaphy, amputation of the cervix and an extensive colpo-perineorrhaphy. This, if properly done, will be just as effective in relaxed vagina as in prolapse of the genitalia. With this latter condition I am quite satisfied that I can get excellent results without adding an abdominal operation, such as fixation of the uterus (or part of the uterus) to the abdominal wall. Therefore this great change in my work you will see has come about during the last seven years.

The important difference between the prolapse of the genitalia and the relaxed vagina with ballooning of the upper reaches of the vagina is that the first is really seen and felt, whereas the second may be overlooked. Never forget that this condition produces very definite psychological symptoms



amongst which are irritability and an altered temperament; a woman becomes snappy and querulous to her husband and child, suspicious and brooding. I do not think this extensive repair is universally known or done, though many advocate it, for instance, such men as Fothergill, Cuthbert Lockyer, McCann, Ralph Worrall and many others. But none seem to be insistent upon the extensive nature of the repair which I demand and though to many it is a hackneyed commonplace subject, I have been forced to allude to it, because I have had so many patients who have been repaired elsewhere and have obtained no relief and I have had to do the work again; extensive repair will give relief. Moreover, during the post-graduate fortnight in Melbourne the graduates seemed overwhelmed with the extent of repair and expressed their fear of breaking into the bowel. If that fear is real, why undertake the operation? It would be better to send the patient to the expert who has no fear of such an accident. Before deciding upon the extent of operation required, careful investigation of the upper parts of the vagina must be made.

There are some few cases in which a simple perineorrhaphy is all that is required. In the great number, however, there is a great relaxation of the upper parts of the vagina with sagging anterior wall and bladder, although not obviously a vesicocoele, and a sagging, slack, loose, posterior vaginal wall, although perhaps not obviously a rectocoele. Between this condition and a complete prolapse of the genitalia there are progressive degrees of relaxation. However, the description of the operation is practically the same in all cases.

#### The Operation.

After curettage the uterus is drawn down by guiding ropes of strong silk through the cervix, the



FIGURE II.

anterior wall of the vagina is practically more or less on a stretch and a V-shaped piece of mucous membrane with the wide end of the V towards the cervix is denuded from the bladder wall (see Figure I). Many surgeons dissect this off with the knife; I find that if the first incision is the proper depth on each side, the layer of mucous membrane can readily be peeled off the bladder wall to the cervix, especially if a little gauze on the thumb and finger is used (see Figure II). Just posterior to the urethral orifice there is very often a heavy thick portion of mucous membrane. This must be removed with the flap of mucous membrane, otherwise it will become nipped in the repaired perineum and cause trouble. Then I



FIGURE I.

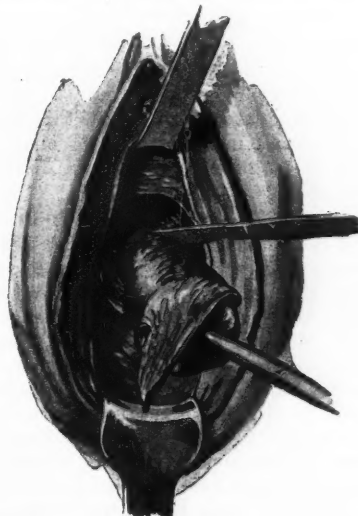


FIGURE III.



FIGURE IV.

push the bladder up from the cervix and fix it in that position by inserting a stitch through the mucous membrane, through a portion of the cervix and across the mucous membrane on the opposite side. If the cervix is to be amputated, the incision is carried on from the mucous membrane incision deeply into half the thickness of the cervix right round. This incision divides two big blood vessels, one on each side of the cervix, the cervical branch of the uterine artery, and one big branch on the posterior wall and one or two smaller ones of lesser moment in the anterior wall. Having made the incision half way through the cervix, one can proceed to enucleate the whole of the cervical canal or to amputate the cervix as the pathological condition will indicate (see Figure III). After the cervix has been removed, the two arteries on each side are tied. I usually put in a deep lateral suture to include these arteries; I have found it safer.

The posterior artery must be tied; as a rule I do not bother about the anterior ones. I, therefore, bring the vaginal mucous membrane to the edge of the cervical mucous membrane at this stage and in doing so I use a particular kind of stitch; instead of employing a single stitch, I use a double stitch (see Figure IV).

The advantage of such a suture is that it brings the edges of mucous membrane together beautifully, the compression of the suture is hæmostatic and stops all bleeding and it reduces the number of ties to half. Schlink<sup>(1)</sup> has described an excellent suture that is used in Sturmdoff's operation, but I have discarded it in favour of the one I describe. All that remains to be done is to tie bleeding vessels on the bladder and to sew up the anterior wall of the vagina which has been denuded of mucous membrane; here let me give a word of warning. Use interrupted sutures and not the continuous; the continuous is attractive and rapid, but it produces too much foreshortening of the anterior vaginal wall.

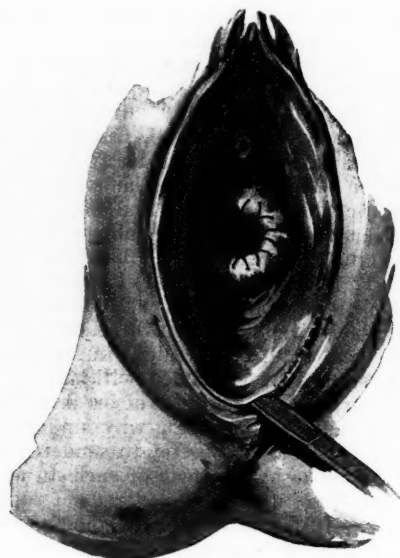


FIGURE V.

All this is simply a description of an ordinary anterior colporrhaphy with a continuation of amputation of the cervix, but in some cases of relaxed upper vagina it is not necessary to remove the cervix and, moreover, it may not be necessary to do any anterior colporrhaphy.

#### Operation for Colpo-Perineorrhaphy.

In the following procedure I think I can claim a little improvement or alteration in an old method adopted. I use no guide ropes to map out my field of denudation. I am about to work at so high a point in the vagina that guide ropes would be inaccessible. With a sharp knife I open into the

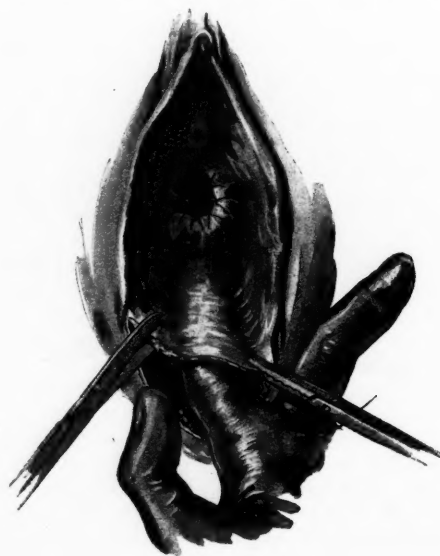


FIGURE VI.



FIGURE VII.

retrovaginal fold at the outlet, separating the vaginal mucous membrane from the perineum (see Figure V). With a few touches of the knife the mucous membrane can be stripped from the *sphincter ani* and *levator ani* and very soon an easy line of cleavage will be reached. With the gauze on the fingers and pressure towards the vaginal flap the whole of the posterior vaginal wall can be released as far as the cervix with the greatest of ease from its perirectal attachment to the bowel (see Figures VI and VII).

In all these so-called dangerous areas the knife has not been used. Far up on each side there are two veins that are usually torn and I have not as yet devised any means of avoiding this occurrence, nor do I think it matters very much.

The thin rectal wall can be seen bulging into the wound, the fingers can evert that great vaginal flap and a visual measurement can be made as to how much or how little of that great slack vaginal wall should be removed.

I am unable to reach as high as I wish until with the scissors I cut through the flap on each side from the perineum upwards and until I cut across a very definite, thickened portion of perineal fascia resembling a ligament.

This incision made by the scissors on each side will release the flap of posterior vaginal wall and make it possible for the finger of the left hand to extrude from the vagina the rest of the flap. The scalpel is now used to mark out how much of posterior vaginal wall is to be removed.

The lateral incisions meet and begin about one and a quarter centimetres (half an inch) below the cervix. A long, continuous suture is tied at the apex of this incision. If not done at once before detachment of the posterior vaginal wall, the apex may not be recognized and asymmetry in sewing up will occur. Before removing the posterior vaginal



FIGURE VIII.

wall I put in my first interrupted suture to build up tissue between the rectum and vagina (see Figure VIII).

The sutures furthest up pick up only perirectal tissue and a few of the broken, torn veins previously referred to. The next two sutures begin to pick up the higher portion of the *levatores ani*.

The whole of the flap of the posterior vaginal wall is then removed by continuing the lateral incisions and in this manœuvre the artery will be cut across

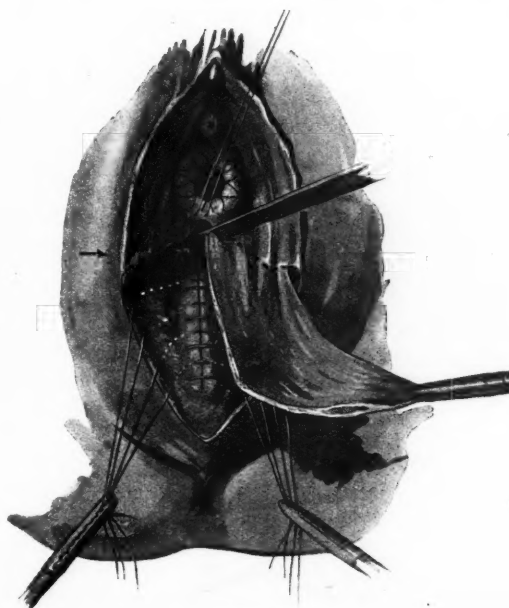


FIGURE IX.





FIGURE X.

which before this extensive operation was not recognized (see Figure IX). It pursues a circular course round the vagina and is three centimetres (one inch and a quarter) below the cervix. Until I discovered that it was circular, I had trouble in arresting the bleeding and it is quite large enough to be very troublesome if not arrested. The continuous suture is continued to a point more than half way down the vagina; then after the wound has been swabbed with iodine the perirectal suture and the other two sutures are tied and three or four more sutures picking up a wide grip of the *levator ani* and if necessary the *sphincter ani* are inserted (see Figure



FIGURE XI.

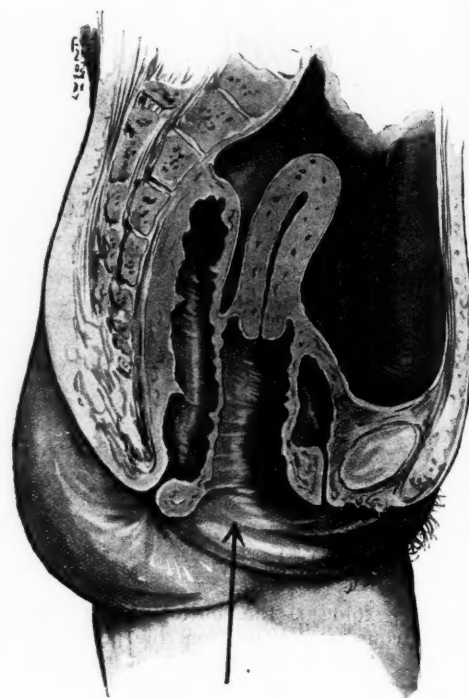


FIGURE XII.

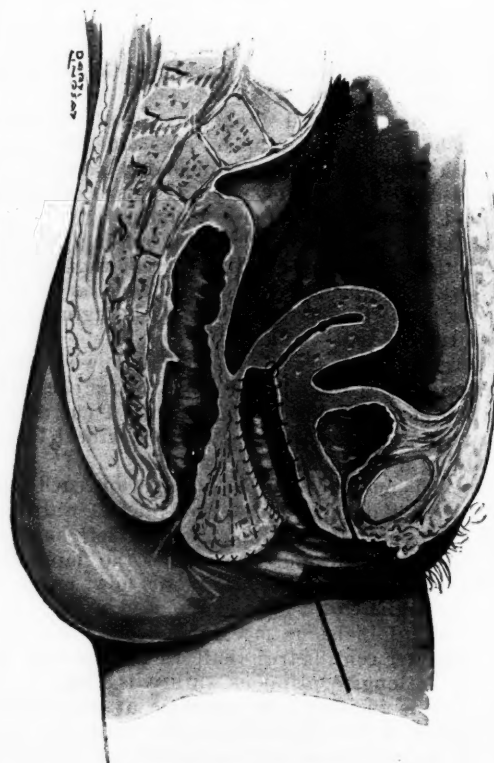


FIGURE XIII.

X). After this has been done the continuous suture is taken a stage further to bring together the cut edges of the posterior wall of vagina. The wound is swabbed with iodine and the perineal sutures are tied. The operator again reverts to the continuous sutures and at this stage great care must be taken. The mucous membrane is now judiciously to be attached to the skin of the perineum in such a way that a funnel is made to the entrance of the vagina (see Figure XI). Great care must be taken to avoid puckering or dragging of skin or mucous membrane. Figures XII and XIII represent sections of the parts before and after operation. Since I have devoted considerable care to this part of the work, I have had no case of dyspareunia. The skin is finished with the same continuous suture.

To recapitulate the following conclusions are reached:

1. I have seen so many bad results from attempted perineorrhaphy that I am quite certain that many of the men operating have not grasped the operative principles I annunciate.
2. All patients on whom I have operated for this condition of prolapsus of the genitalia and relaxed perineum, have been examined; the results are perfect.
3. During the last few years I have relied upon vaginal plastic work for prolapsus of the genitalia and have discarded all abdominal aid such as fixation of uterus or part of it.
4. This plastic work requires such skill and knowledge that it should be performed only by those specialists who have the opportunity of acquiring that skill and knowledge.

#### SECTION VII.—OTOLOGY, RHINOLOGY AND LARYNGOLOGY.

##### THE OPERATIVE TREATMENT OF DISEASES OF THE MASTOID.

By T. A. MACGIBBON, B.A., B.Sc., M.D., F.R.C.S.  
(Edinburgh).  
Christchurch.

The operative treatment of diseases of the mastoid may be roughly divided into three sections:

1. Operation for acute suppurative mastoiditis complicating acute suppurative *otitis media*;
2. Operation for acute exacerbation of a chronic mastoiditis or an acute mastoiditis complicating a chronic suppurative *otitis media*;
3. Operative interference in chronic mastoiditis along with chronic suppurative *otitis media*.

It would take up too much time to describe the operations for sinusitis, extradural, subdural and intracranial abscesses and meningitis as complications of *otitis media*.

In the acute cases it is hardly necessary to say that a reddened skin and even œdema are not a sufficient indication for opening the mastoid. Even

the sagging of the upper and posterior wall and general reddening of that wall are not always a sure indication.

I admit that it can hardly be considered a mistake to open an inflamed mastoid early, but certainly not within thirty-six hours of the onset, unless one suspects one of the so-called fulminating cases. It is said that the presence of the *Streptococcus mucosa* indicates immediate exposure of the cells as cerebral and meningitic infection may come on with extreme rapidity and end in almost immediate death. One suspects this organism when the symptoms are profound; the patient is very ill, the tongue is dry and furred, the temperature may or may not be very high, but there is a rapid and hard pulse and the skin is pale and slightly damp, the hair tending to mat on the scalp. In nearly all these cases of fulminating infection there is severe toxæmia and there may be brain symptoms, though not necessarily brain infection. It is a recognized fact, of course, that toxins from severe infections of the nasal sinuses and the middle ear tract can produce brain irritation and brain poisoning or toxæmia. Generalized and dull headache would put one at once on his guard in such a case. Here I would open the mastoid cells extensively, without waiting to perform paracentesis and to have a culture made.

But in the ordinary case one examines the drum-head and meatus and gets one's indication from what one observes there. If the patient is seen before rupture of the drum-head it must be decided whether paracentesis will be sufficient or whether it would be waste of time to do that small operation. My index for that procedure is the character of the membrane and the appearance of the wall. If the drum-head be red and bulging and the wall only taking part in the general congestion, then paracentesis may be sufficient. It is not part of my duty here to describe that operation. I simply state that many a mastoid operation might have been avoided if the membrane had been freely incised under strict aseptic precautions in the early stages of the middle ear disease. The inflammation will subside rapidly and the mastoid cells settle down. But when the discharge has become purulent and profuse and does not respond to local treatment within ten days to a fortnight, I think definitely that the mastoid should be opened. Of course, if the fever, pain and other symptoms do not subside on the appearance of free discharge, one does not wait more than twenty-four hours or there may be disaster. The time for interference must be decided by the general appearance of the patient, the discharge, the pulse and the state of the tissues over the mastoid process.

#### The Operation.

It is a generally accepted rule that only one operation should be done in an uncomplicated case of the first section. It is never necessary to do a radical operation.

The operation is that of Schwartze or the classical mastoid. The usual procedure is as follows:

A curved incision is made one centimetre behind and parallel to the sulcus where the pinna is attached to the skin of the head behind. A straight incision is only mentioned to be strongly condemned. Only one who has to do the operation over again, knows what a nuisance that incision is and when a radical operation has to be done, it spoils the wound. The incision usually starts at the tip of the apex of the mastoid process and ends just above the upper boundary of the bony meatus. Below the temporal muscle the incision is carried down to the bone. Care should be taken not to wound the temporal muscle or its fascia. It is unnecessary and often causes much troublesome oozing. With a raspatory the periosteum is carried forwards until the posterior border of the bony meatus is just seen; the posterior border of the wound is very slightly pushed back. The lower border of the temporal fascia is cut from its attachment to the periosteum and the muscle pushed up until the upper wall of the bony meatus is seen. Sometimes the muscle overhangs Macewan's triangle and may need to be held up with a retractor. Now, as to the means of reaching the cells or the antrum. Macewan, using a hammer and chisels, mapped out his famous triangle, including the supra-meatal spine and worked in until the antrum was reached. The antrum may be six millimetres (a quarter of an inch) deep or even nineteen millimetres (three-quarters of an inch) deep and I feel that one may be working too much in the dark and may wound the sinus, the brain or even the seventh nerve. Others approached the antrum by pushing forward the skin of the bony meatus and attacking the cells or antrum from the anterior wall of the mastoid.

The method I adopt is to enter the cells from the apex on antero-lateral aspect. There one is away from the sinus, the brain and the seventh nerve. In very small children it is said that one may wound the seventh nerve at its exit, but if the apex be properly exposed and the incision made from below upwards, the finger and the thumb of the other hand grasping the tip of the apex; there should be no fear of that.

I use Lake's gouges and having found the apical cell which is nearly always present and is mostly enlarged as a result of the necrosis which has been going on, I proceed upwards, hugging the posterior meatal wall. Sometimes, about the middle of the posterior meatal wall one finds the lateral sinus close up. It is said that this occurs very often on the right side. I do not worry about this. I may uncover the sinus and often I am glad to see it. Usually one finds that the bone covering the sinus is white and hard (compact) and quite distinct from the friable walls of the cells. Almost invariably one gets grey pus or thick muco-pus as soon as the cortex is opened. Very rarely one finds serum or blood and does not get pus or muco-pus until the antrum is reached. Having proceeded upwards one turns inwards and forwards to the antrum, which is usually at a deeper (more internal) level than the cells. Here care must be used; the surgeon must not take Macewan too literally; if he does so, he

will open into the middle cerebral fossa, for the floor of the fossa to the outer side is at a lower level anatomically than the tegmen of the antrum. The next question to decide and there is a diversity of opinion about this, is whether or not to do a complete exenteration of the cells and a free exposure of the antrum. I have stopped at the antrum and drained and the wounds have healed up, but again they have not.

It is usual now to open widely all the cells and to get rid of the intervening septa, leaving as smooth a surface as possible. In doing this one may have to go far back behind and internal to the sinus, even into the occipital bone and may have to open cells in the root of the zygoma. In three cases I have traced pus through the zygoma into the subtemporal region where there was a large collection of pus. It is important to follow up every drop of sero-mucopus. Now, as to laying bare the antrum. If one is satisfied with the opening into it and that the walls are smooth, one may stop. However, I usually throw the antrum into the wound and examine the aditus. Here, again, one is faced with a difficulty. Should a probe be passed into the attic or not?

Some say that this will cause dislocation of the incus. It is difficult to dislocate that bone, unless one has chiselled away the *fossa incudis*. The aditus is above this and it may be enlarged upwards and outwards, but never downwards. It may be necessary to smooth away the inner wall. The risk of opening into the external semicircular canal is very small. There is another reason why the floor of the aditus should not be touched; here the Fallopian canal turns outwards and downwards, but it can be injured only with rough handling in acute cases, unless there is a dehiscence which very rarely obtains. In chronic cases the seventh nerve is not so well protected. I do not wish to minimize the risk to this nerve; chisels and burrs should never be used in this area as they cannot be controlled. Gouges and spoons are the only justifiable tools to use.

Having satisfied oneself that the walls are smooth, that there is good drainage from the middle ear, what should one do now? Some flush the cavity out to get rid of the *débris*, but I am afraid of injuring the middle ear at this time and have stopped this procedure. I mop out the cavity as well as possible and proceed to apply bismuth-iodoform-paraffin paste. This paste is not necessary.

Now comes the vexed question which has been causing much heart burning and much correspondence in the journals. Is one ever justified in stitching up the wound completely?

If one has found pus, I say never. If not, then has not one operated too soon or made a mistake? My practice is to stitch up the skin wound as far down as the lower border of the temporal muscle and leave the rest open. Others stitch to within twelve millimetres (half an inch) of the lower angle on the wound and leave in a drain which is removed in two or three days, allowing the wound to heal up. That is all very well for a wound in an ordinary

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bone, but here we have an infecting tract, the Eustachian tube and the middle ear which are both actively secreting. I think that the old procedure which I adopt, gives the best results. Rapid healing pleases the patients, but in many cases the wounds break down again and the operation has to be repeated. Sometimes even a cavity is left and on opening it one finds foul, dark, blood-stained fluid in it or one finds an encysted or semiencysted sac of muco-pus. If the healing takes place slowly from the aditus to the surface, one is sure to have tough fibrous material, not easily infected by subsequent inflammations of the middle ear, filling up the cavity.

The dressings are carried out every second or third day, unless the discharge be so great that daily dressings are demanded. There is an operation called the conservative mastoid operation. This has been carried out chiefly by Mr. Heath and his followers. It is not in good repute. It consists in removing the posterior bony wall down to within two millimetres of the drumhead, so preserving the membrane, ossicles and aditus. The posterior cutaneous wall is cut into flaps as in the radical operation and the posterior skin wound stitched up. All dressings are done through the meatus. The difficulties are that there is a constant discharge, at least for some time, in the neighbourhood of the membrane; it is impossible to pack the wound and to keep the meatus free and it is impossible to limit the growth of the granulation tissue forwards, thus obstructing the meatus. The fairest criticism is that the classical mastoid operation is all that is needed in acute mastoiditis; when it is necessary to remove the posterior bony wall, a radical operation will give better results.

#### The Radical Operation.

When should the radical operation be done? We are not considering complications such as intracranial affections.

In uncomplicated cases of chronic *otitis media* this operation is done only under certain conditions. On the Continent it is the teaching of Siebenmann and others that only when there is evidence of the presence of cholesteatoma should this operation be done. They say also that whenever cholesteatoma is diagnosed, the operation is imperative.

Others, notably the Edinburgh School, of whom the chief is J. S. Fraser, would go further than that. They consider that chronic discharge from the antrum, which resists treatment, is a sufficient warranty for the radical operation. This opinion is fortified if there be exacerbations of discharge with mastoid pain, facial neuralgia (fifth nerve) and giddiness. The character of the discharge is important. If the discharge be muco-purulent or mucous, without any odour and with no evidence of bone necrosis (one could tell this by examination of the discharge under the microscope), then one might withhold one's hand indefinitely and keep the canal clear of discharge, preventing irritation of the walls of the external meatus, if possible. Fœtor,

giddiness, headaches, neuralgia and toxic absorption (aproxia, loss of memory) would suggest a radical operation. But in these cases cholesteatoma is almost invariably present.

Persistent or repeated attacks of vertigo with hyperirritability of the vestibule (Bárány's test) or paresis of the seventh nerve is always an indication for the radical operation.

The incision is made further back than that for the simple operation. It should be a curved one in the hair-line and well behind the posterior limit of the bony operative cavity. Thus one prevents depression of the scar and irritation of the scar by sweating in the sulcus and by the wires of spectacles. The bone is exposed in the same way as before, but the upper part of the incision is carried in its curve forward until it is directly above the root of the helix. The temporal muscle is drawn up, the periosteum is carried forward as before, but the detacher now separates the periosteum from the posterior bony meatal wall inwards to the membrane or what is left of it. By means of gouges or chisels the antero-external border of the mastoid process from the spine to the tip is carefully removed until the antrum is exposed. Here one may not find cells. In most cases sclerosis of the process is found with obliteration of the mastoid air-cells. Usually, however, the antrum is enlarged, though occasionally it is so small as to make the operation extremely difficult. In the gradual removal of the bony partition between the external and middle meatus and the mastoid process, one comes at last close to the aditus. Some bold operators go on with the chisel and gouge and remove this bridge exposing the aditus in their stride. Cautious operators now halt and examine the aditus. If this operation be done chiefly for cholesteatoma, this is wise, because one does not find the anatomy in accordance with the text books. There have been destruction of bone and the deposition of new sclerotic bone and the landmarks may be very much altered. However, the deposition of hard bone is chiefly in the region of the original cancellous or diploetic tissue and rarely in the compact bone. But the compact bone may have disappeared and in that case one gets gaps or dehiscences as in the case of the facial canal and the *tegmen tympani et antri*. Up till quite recently Stacke's protector was placed in the aditus, while the bridge was chiselled away. The protector was to catch the edge of the chisel after severing of the bridge when it was separated from the tegmen. This is now recognized as the cause of injury to the seventh nerve which takes a part in the formation of about one-third of the circumference of the aditus (part of the inner and all the floor of that passage). If the wall of the canal is weakened by erosion, a sudden blow may jar the nerve or drive a spicule of bone into the nerve and cause temporary or a permanent facial paralysis. Personally, I remove the bridge with a fine gouge or a pair of special punch forceps, one jaw of which is passed through the aditus. The jaw that is passed through the aditus, must be the

moving jaw, so that in closure it is drawn away from the nerve. The most particular part of the operation is the paring down of the posterior ridge (facial ridge) until practically only the seventh canal is left. It must be remembered that the canal passes from the aditus to the stylo-mastoid foramen, not directly downwards, but though mostly downwards it also passes somewhat outwards and backwards. The backward direction allows one to remove more of the posterior wall in the region of the well and thus to bring the cavities of the middle ear and the mastoid into easy relationship and facilitate epithelialization. After the bridge has been removed, the small bones excepting the stapes are removed if they are present; they are absent in most cases. The remains of the membrane must be carefully removed otherwise a septum will form across the operation cavity later on. All the mucous membrane must be thoroughly removed, except that around the *fenestræ*. Care should be exercised not to remove the stapes. This little bone is rather more difficult to remove than the books allow, though it is customary to warn the operators. In fact, in the cases where the operation is justifiable, the stapes is usually ankylosed to the walls of the deep *fossula ovalis*. But the two chief points about this part of the operation are to see that the outer wall of the attic and its prolongation over the antrum are carefully removed and that the cells or their remaining septa are removed, leaving nothing but the smooth tegmen. Any shelves or overhanging edges will ruin the operation afterwards. Finally, free curettage of the Eustachian canal must be carried out forward to the cartilage, that is, nearly thirteen millimetres (half an inch). One aims at closure of this tube; in 70% of the cases do we get closure in Christchurch, whereas, in England, they do not seem to get more than 33%. Sir William Milligan was so exercised with this difficulty that he tried cauterizing the mucous membrane of the tube by passing an electric cautery needle into the tube from the pharynx. But when it is considered that the mucous lining of the tube is in convolutions as in the Fallopian tube, it is recognized how difficult and dangerous a procedure this is. In curettage it must be remembered that the internal carotid artery is separated only by a thin wall from the tube. The cavity is now complete. All byways have been investigated. The tegmen and the coverings of the lateral sinus and jugular bulb have been examined for signs of necrosis or perforations. It would be quite correct to expose the dura in these cases to be quite sure that there was no spread of infection. Exposed dura is harmless, but if it be exposed it should be noted and where, so that at the next operation injury of the dura may be avoided. Some operators, including Fraser, flush out the cavity. I follow the Americans and Nagar and content myself with mopping out. Flushing makes a mess of the surrounding parts and all that it does can be done with damp mops. Sometimes I apply bismuth-iodoform-paraffin paste to the cavity at this stage. I now put in a temporary dressing, filling the cavity nearly to the

bony limit. The next stage is the formation of the flaps. A variety of flaps is found. Fraser uses the central flap. He makes two parallel and horizontal incisions in the posterior skin wall of the external meatus, one on the upper limit of the external meatus and the other at the lower. The flap is then stitched forwards to the inner surface of the skin in front of the original incision. Fraser removes any surplus tissue, including portions of the auricular cartilage, from the flap. This skin forms part of the lining of the cavity, that is the outer wall. The meatus is correspondingly enlarged.

Fraser now puts in a skin graft which he takes from the thigh. This is laid in in the form of an old-fashioned purse and the (epithelial surface) hollow filled with gauze impregnated with iodoform emulsion so as to make the skin apply itself to the bony walls. The mouth of the sac of the graft is partially closed in with the flap, but that opposite the new meatus is left free; from this gap the dressing can be removed in from five to seven days.

The method that I use is the T-shaped one, forming an upper and a lower flap. There is a transverse horizontal incision of the meatal skin made outwards to the concha and these I turn up and down to the limits of the meatal opening. Portions of cartilage have to be removed from these flaps which are now stitched backwards and up and down as the case may be and held in position by deep silkworm gut sutures above and below the limits of the original incision. As the two ends of each suture come out close together, I tie them over rubber to obviate the very real risk of cutting these ends and leaving the suture inside the wound.

The wound is now carefully stitched up with silkworm gut. The final act is to remove the temporary dressing and gently but firmly pack the cavity out to the concha with medicated gauze. I use bismuth-iodoform-paraffin paste or iodoform. This is left in for seven days.

There are other flaps made, but these are the two in common use. I do not use skin grafts and rely on the after treatment and the encouragement of the spread of the epithelium over the granulations, from the flaps.

I noticed that Fraser used the graft in only one out of four cases I saw him do.

The graft is said to cut short the after treatment and to prevent the deposition of much tissue between the epithelium and the oval and round windows. This insures good hearing if the internal ear is intact.

In describing this operation I have limited myself to the ordinary radical procedure on the mastoid. There are numerous departures from the normal method and these depend on complications and irregularities discovered during the performance.

(To be continued.)

The name of Dr. C. A. Hogg, of Sydney, has been inadvertently omitted from the list of members which appears on pages 3, 4 and 5 of the Supplement to THE MEDICAL JOURNAL OF AUSTRALIA, August 13, 1927.

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